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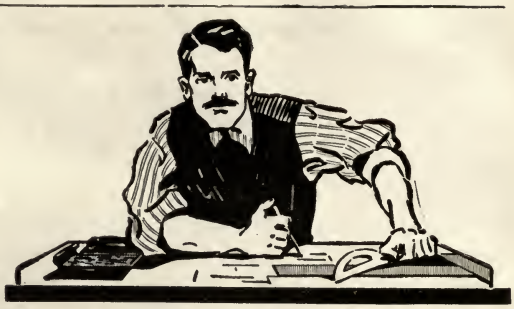

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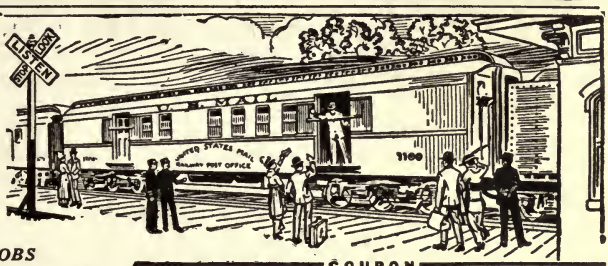

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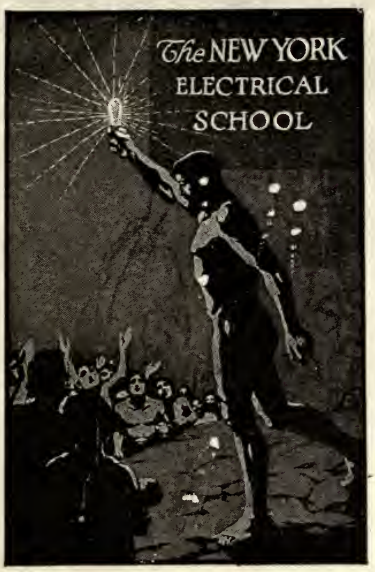

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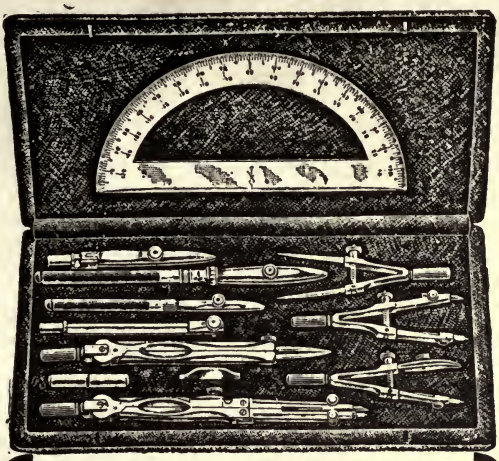

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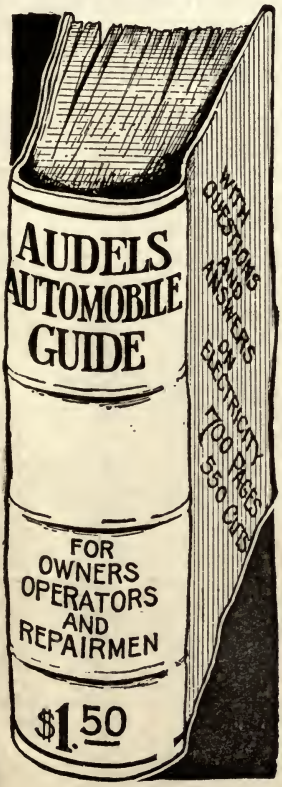

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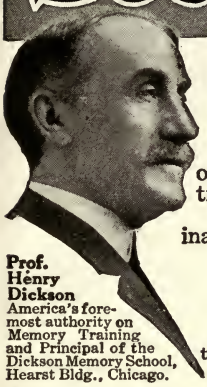

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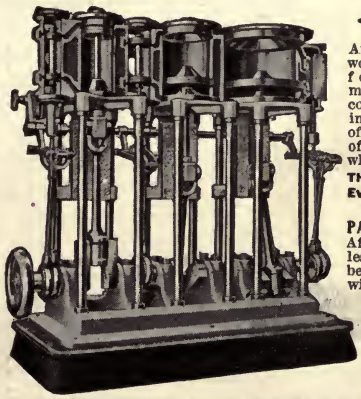

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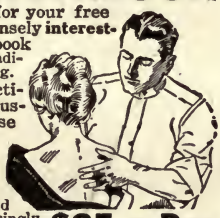

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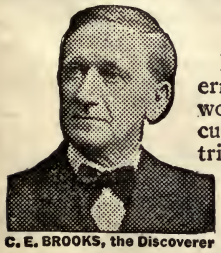

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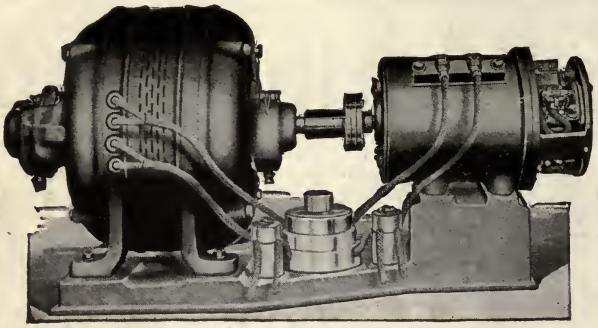

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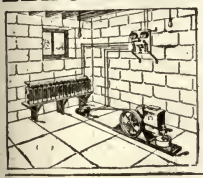

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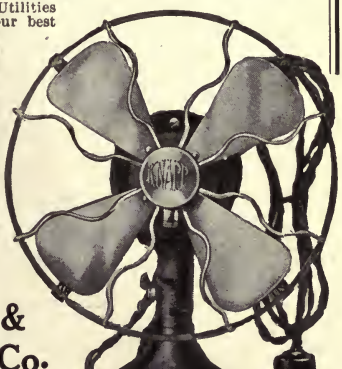

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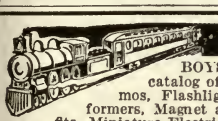

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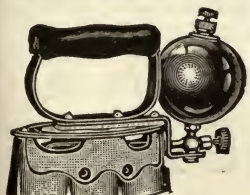

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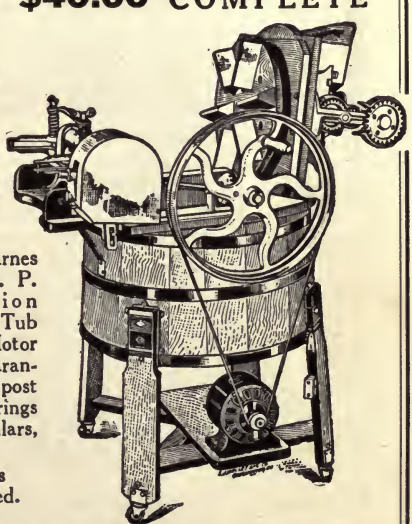

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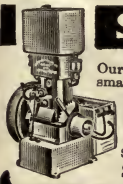

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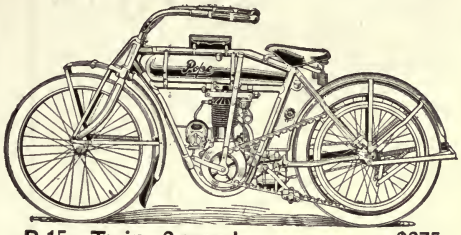

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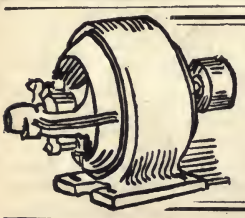

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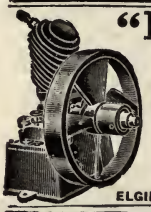

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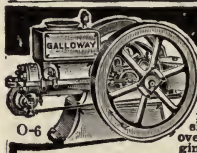

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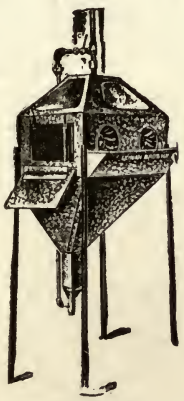

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They take up their own wear and they are the only blowers and vacuum pumps that do. They are so simply constructed that they can't possibly get out of order—just the machines for automatic devices.

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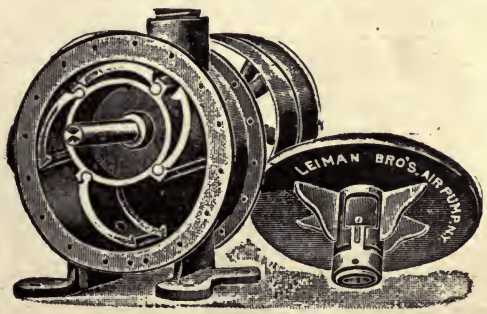

THE WORLD'S ADVANCE MAGAZINE

FORMERLY

POPULAR ELECTRICITY AND MODERN MECHANICS

Classified Advertisements

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SHOP Vulcanizer. Bargain. Tires at cut prices. Vanderpools, Springfield, Ohio.

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WIRELESS

AERIAL MASTS — "Superfect" type. J-230, Stuyvesant Ave., Brooklyn, N. Y.

FOR SALE—Clapp-Eastman one kilowatt, type "C," high tone, sending set complete, practically new, includes everything necessary for high-grade station. Price reasonable. Write L. R. Stanley, Swampscott, Mass.

BARGAIN!—One kilowatt transformer, rotary gap. A. W. Gavett, South Portland, Me.

ONE-QUARTER kilowatt Peerless set, very good condition, $17.50; one-half kilowatt Blitzen transformer, in case, good as new, $18.00. Lester Jenkins, New Bedford, Mass.

BLITZEN Receiving Set; phones, other wireless instruments; perfect condition; half price. E. F. Rybolt, Dayton, Ohio.

FOR SALE—Blitzen receiving set without receivers. Fine condition. $13.00 takes it. Walter S. Leigh, Clinton, N. J.

WE make loose couplers, 2,500 meter, $5.00; tuning coils, 350 meter, $2.00. Cliff Mfg. Co., box 130, Brookfield, Mass.

"WIRELESS HOOK-UPS," containing 96 pages and 100 hook-ups, is full of diagrams fully illustrating every possible wireless connection. This book will enable wireless men to get excellent results. Sent postpaid for $0.25. Modern Publishing Co., Book Dept. 239 Fourth Ave., New York City.

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The right is reserved to rewrite or reject any advertisements which will not be for the best interests of our readers.

Advertisements of articles intended for sale cannot be accepted, as a regular classified department is conducted for advertising of this character at 10 cents per word.

All advertisements for this department should be addressed to "Apparatus Exchange Department," THE WORLD'S ADVANCE, 239 Fourth Avenue, New York.

HAVE general stamp collections; value about $20 each; will exchange for typewriter, camera, magic lantern, or bicycle; also have some books and magazines that I will exchange for other books and magazines. Edmund Beck, Whittier, N. C.

WANTED—A complete headset of standard make in exchange for receiving set that receives up to 1,000 miles. Make me an offer. Clarence D. Miner, 412 Cedar St., Niles, Ohio.

WANTED—Several good eight-day clock works, A. C. wattmeters and fan motors. Address J. Nordstrom, Gallitzin, Pa.

WANT—Smith motor wheel; have complete receiving set, including Blitzen variable condenser, 'phones, commercial loose coupler, etc. Edward French, Peekskill, N. Y.

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APPARATUS EXCHANGE

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FOR EXCHANGE—Typewriter, want motorcycle. J. Bufka, R2, Denmark, Wis.

WILL EXCHANGE—Rotary condenser, pair of 2,000 ohm receivers, for good camera or offers. H. V. Butterworth, 15 Kosciusko St., Brooklyn, N. Y.

WANTED—Audion detector, flexible transformer any size, line protector for 110 volt circuit, large spark coil and other wireless goods in exchange for large loose coupler; wound for 3,000 meters; one-half KW. sending transformer and a new $25.00 mandolin. H. A. Thorndike, Fitchburg, Mass.

HAVE for exchange lantern slides, negatives, films, Tribune tandem, Seneca camera, flint lock pistol, English make; want large lantern slides or views of historical places, Indian relics, curios and electric fan. Brodstone, Superior, Neb.

FOR EXCHANGE—One-half KW. transformer coils, three-slide tuner and loader style "C" one, and two KW. gaps; 30-30 Stevens repeater rifle (new), detectors, electrolytic interrupters, old violin, marine engine, Detroit make; 2½ H.P., two cycle, 20-22 diamond auto engine, complete to run. Want rotary converter 110 D.C. to 110 Volt, 60 cycle A.C.; rotary spark gap of standard make or transformer of standard make. G. L. LaPlant, St. Anthony, Iowa.

HAVE for exchange the following articles, value $56.50: One loose coupler, $9.00; fixed condenser, $3.00; crystalol detector, value $3.00; variable condenser, $5.00; detector, $3.00; loading coil, rewound, $5.00; two S. S. tuning coils, $5.00 each; 2,000 ohm phones, complete, $10.00; buzzer test with key, $2.50; 1-lb. tested galena, $1.00; one D. P. D. T. switch, $2.50, and one D. P. D. T. switch, $1.50. Will exchange for motorcycle or what have you? All the above articles are in first-class condition. G. O. Fackrell, agent Sierra Railway, Cooperstown, Cal.

HAVE Blitzen receiving set, 2,000 ohm phones; many other wireless instruments; X-ray outfit, two-inch spark coil; write for list. What have you in exchange? E. F. Rybolt, Dayton, Ohio.

WILL EXCHANGE high-grade 2-inch wireless spark coil, eight-point adjustable condenser, spark gap, brass key and helix for Audion detector or what have you? J. Miller, 33 Windsor Place, Brooklyn, N. Y.

HAVE De Forest audion with stand, mounted on hardwood case, with rheostat, switches, etc. Want good coaster brake bicycle. Edward French, Peekskill, N. Y.

FOR EXCHANGE—An auto sparker or dynamo; cost, $28; weight, 23 lbs.; was used on an automobile to develop current for a spark coil. Will take wireless or electrical things for it. Also have a ½ KW. transformer, $5; fixed condensers, gas engine coil, sensitive galvanometer, electric bell, electric thriller, shocking coil without vibrator, and "Fun with electricity outfit" (St. John's); besides magazines, etc. All things in good condition. Would like especially such articles as 100 ampere ground switch, Murdock 43-plate rotary variable condenser, "Electro" loading coil and a good spark gap; act quick. Donald M. Terry, Scott, Ohio.

FOR EXCHANGE — Quantities of tested galena; if you have wireless goods to exchange, write. George T. Hunter, 203 Miami St., Urbana, Ohio.

FOR EXCHANGE—A complete wireless receiving set, consisting of $12.00 loose coupler, $10.00 phones, $3.00 variable condenser and $1.00 fixed condenser, mounted on mahogany base, unpacked but not used. Will sell separately or complete. Also sending instruments and desk; make offer. Well. Van Slyck, 836 Main St., Lake Geneva, Wis.

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USE THE AUDION

Used with an amplifier, you can get distances you never dreamed of.

Better send us a one cent stamp and get wise. Do it now.

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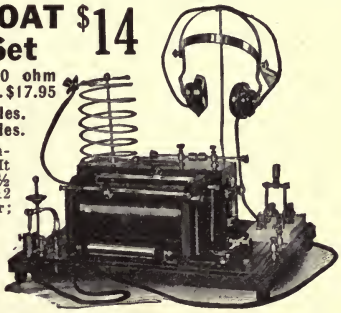
Equipped with 2000 ohm headset $17.95

Receives 2000 Miles. Sends 15 to 30 Miles.



This station is complete in every way. It consists of a full 1½ inch spark coil; 12 flat plate condenser; our "Don't Jar Out" detector, buzzer and switch. Double slide silk wire wound tuner of long wave station capacity, fixed condenser, helix, key DTDP switch.

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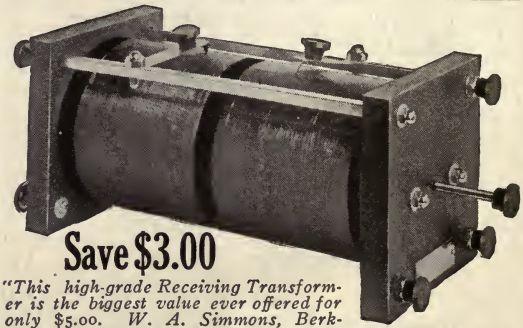

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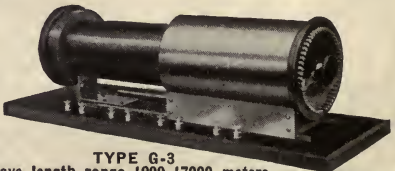

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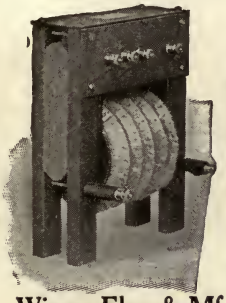

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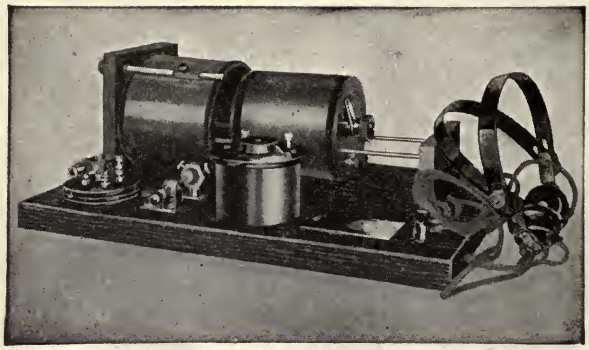

Your Apparatus

Should Give You More Than Actual Service

It Should Give You a Sense of Pleasure and a Pride of Ownership

Radion Receiving Set, complete with 2,000 ohm head set and Ferron Detector $26.00

Clapp-Eastham apparatus costs no more, and carries a feeling of pride and security which attaches only to a standard product of established reputation.

Our catalog fully describes and illustrates a product manufactured since 1907, and is delightfully free from the usual advertising superlatives.

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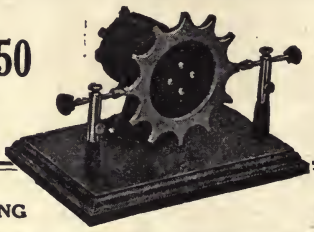
CLAPP - EASTHAM CO.

143 Main Street, Cambridge, Mass.

$11.50 Mahogany Base



$12.50 Marble Base

NO WABBLING — RUNS STEADY

Chambers Rotary Spark Gaps

Gives a tone similar to a flute on 60 cycles. Our spark gap runs on 110 D. C. or A. C. and is suitable for ¼ to 1 K. W. Motors furnished in two sizes with ¼ inch shafts.

Full details of prices and sizes, etc., in our new illustrated catalog B-24 sent on receipt of 5c in stamps.

F. B. CHAMBERS & CO., 2046 Arch St., PHILADELPHIA, PA.

HIGH TONE ROTARY

Runs 8,000 R. P. M.

GIVES 600-CYCLE WHISTLING SPARK LIKE A QUENCHED GAP.

Attains full speed in one second; stops dead inside of three seconds.

More power can be radiated at high-spark frequency than at low. Greater efficiency.

Light revolving discharger allows high speed without heating. Signals easily read through static.

Requires less sending condenser.

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"C" contains many new pieces of apparatus.

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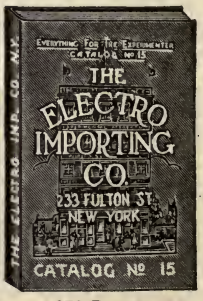

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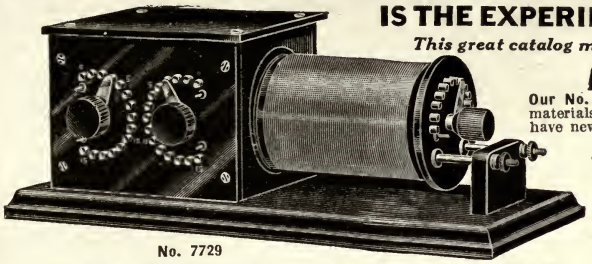

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Represents the latest advances made towards the ideal tuner and embodies the greatest degree of perfection yet obtained. No greater value can be secured where accurate selectivity, sensitiveness and finish are desirable, The illustration shown herewith cannot possibly do justice to the instrument itself. The primary winding is enclosed in a cabinet, the sides and top of which are polished hard rubber. Two 15 point switches are mounted on the front. One switch controls the primary in groups of several turns and the other controls one turn at a time. The entire variation of the primary is thus secured by the rotary motion of two knurled knobs rather than the movement of a slider, and may be varied from **1 to 225 turns in steps of one turn at a time.** The windings are especially adapted to long wave lengths. The secondary is wound with green silk covered wire. The ends are HARD RUBBER, turned and polished. Secondary variation is secured by a 12-point switch which makes it possible to secure a very fine adjustment. **PRICE ONLY $15.00**

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Complete description and prices of the latest Electrical and Experimental Apparatus—Storage Batteries, Rectifiers, Transformers, Induction Coils, Wireless Apparatus, Lamps, Flashlights, Meters, X-Rays, Books, Tools, Electric Railways, Steam Engines, Water Motors, Dynamos, Motors, Telegraphs, Telephones, Electrical Supplies, Model Aeroplanes and Parts for building your own apparatus. FREE with each catalog a Treatise on Wireless Telegraphy, telling how to put up an aerial, connect apparatus, together with a Call list and Wiring Diagrams. 6c in stamps will bring you this wonderful book. The best catalog of wireless apparatus, etc., published.

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Variable Condenser, 25 Aluminum Plates, Slide Type.. 2.75

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You can have it at remarkably little cost by using our ½ K-W Transformer. Has 30,000 turns, gives you 13,200 volts.
Write for special proposition to wireless amateurs.

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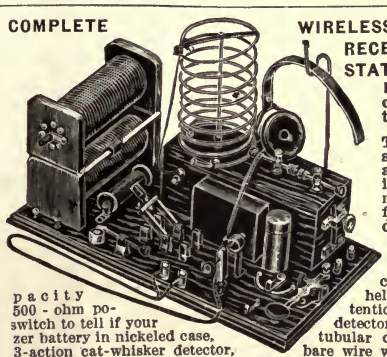
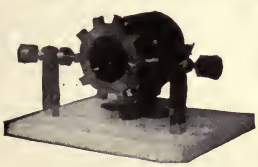


Receives hundreds of miles. Send 8 to 20 miles.

This remarkable station consists of a guaranteed 1½-inch spark coil, machine-turned fluted spark gap, our 1501 key, a flat plate condenser assembled in an oak case, a large capacity helix, DPDT switch 500-ohm potentiometer, buzzer and switch to tell if your detector is working, buzzer battery in nickeled case, tubular condenser, our new 3-action cat-whisker detector, bare wire wound double slide tuner, No. 30 silk wire wound large 6 capacity loading coil that allows you to get Arlington and long wave stations. Send stamp for our large catalog "G" of remarkable values. If possible call and see our stock. **THE HANDEL ELEC. CO., 138-140 Centre St., N.Y.**



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This gap consists of a light, durable, non-warping disc, on a high speed 110 volt A. C. or D. C. motor, mounted on a white marble base, giving an efficient, smooth running gap, of neat appearance and having a clear, musical tone.

Type		
T-2,	1-4--1 K. W. Gap,	$12.50
T-2,	5 in. disc.,	4.50

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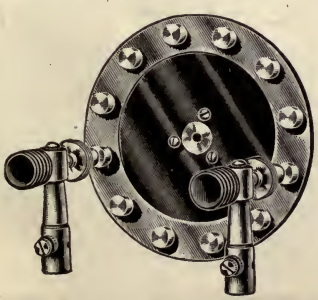
AULL-ZIEGLER WIRELESS MFG. CO., East St. Louis, Illinois.



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This is the only road to wealth for the investor. The wise man **buys** when **few** are buying—and gets a bargain. He sells when **many** are **buying**—and makes his profit. That rule is the basis of all fortunes that have been made in real estate.

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AN EXTRAORDINARY OFFER

Choice Building Lots at $59.00 Each
$1.00 Down and $1.00 per Month

Our lots at $79.00 each in the southern section of Oak Ridge Park, Long Island, have been snapped up so quickly that we are forced to open up the northern section earlier than we had expected. To start this off with a rush, we have laid aside fifty of these lots to be sold to early buyers at the special opening price of $59.00 each. We will not sell more than five at this price to any one customer. After these are gone, the price for the remaining lots will be $79.00 each. To take advantage of this special offer, therefore, you must write AT ONCE.

The wonderful increase of values on Long Island is one of the marvels of latter-day history. In scores of towns property has increased not only 50 per cent., 100 per cent., but in many cases 1,000 per cent. Lots that sometime since could have been bought for a song are to-day worth thousands of dollars. A few years ago, some school teachers bought lots in Hempstead, Long Island, at fifteen dollars each; to-day the lots sell for six hundred dollars apiece. A short time ago, a physician bought two lots at Long Beach, at ninety dollars each; recently he sold them for a thousand dollars apiece. These are only two out of thousands of similar instances.

Out of the sweltering, crowded city of New York thronging thousands are pouring into the suburban towns and cities of Long Island. Hundreds of millions of dollars are being expended by the Pennsylvania Railroad alone, for its development. Tremendous engineering works—tunnels, bridges, railroads, electric roads—are under way, involving more money than the Panama Canal. What the bridge did for Brooklyn, what the subway did for the Bronx—multiplying values enormously almost overnight—these gigantic transportation schemes of the Pennsylvania Railroad will do for Long Island. It will furnish the fastest, finest and the most comfortable rapid transit in the world.

We are offering for sale at remarkably low figures choice building lots located at Oak Ridge Park, near East Moriches, the world-famous summer resort, on the Pennsylvania Long Island Railroad. Every foot of ground is high, dry, fertile and healthful. The property is only seven minutes' walk to the station and twelve minutes' walk to the Great South Bay, with its glorious facilities for still water and ocean fishing, swimming and boating. For a summer home or bungalow, for small fruit or poultry raising, or to hold as an investment, these lots at our prices cannot be surpassed. The title to the property is insured by the United States Title and Guarantee Company of New York City.

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JULY
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BUY NOW. Begin **TO-DAY** to provide for your future and that of your family. Get into the land-owning class and break away from the tyranny of landlords. Values are increasing by leaps and bounds. If you buy five lots now you ought before long to sell any one of them at what you paid to-day for the five. **DO NOT WAIT** until the gigantic improvements on Long Island now in progress are completed; until prices climb enormously; until the lot that you can buy to-day at $59.00 is selling at $300.00 or more. Make sure of reaping that profit yourself by acting **NOW.** Fill out this coupon and send to-day for our beautifully illustrated booklet, FREE.

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This unrivalled catalog mailed to anyone upon receipt of 8c in stamps or coin which may be deducted on first dollar purchase. Great cost of catalog and low prices prohibit distribution otherwise.

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when this catalog contains practically everything worth while in wireless and electrical goods, advertised in this and all other magazines,—and in most cases at *more* attractive prices.

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5 Contact Points—Finer Adjustment—More Sensitive Than Ever

The Audion Detector is 1½ to 3 times as sensitive as any form of crystal or electrolytic detector. These two characteristic testimonials from Council Bluffs, Ia., and St. John, Kans., speaks for themselves.

"I suppose it sounds almost unbelievable when I say that I can hear Port Arthur (VBA) with the phones a foot away from my ears and (NAR) Key West almost that far, but such is the fact."

"I set the Audion up and after a few adjustments I was able to hear Sayville, Colon, Panama, Key West, and a host of others that are here closer at home."

What This Big Catalog Contains

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15 pp. Telegraph Insts.;
42 pp. Motors and Dynamos;
10 pp. Miniature Lamps;
8 pp. Flashlights;
5 pp. Massage Vibrators;
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INCLUDES

Rotating Gaps	Tuning and Loading Coils
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Made Well *Priced Right* *Shipped Promptly*

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"INCOMPARABLY SUPERIOR TO ANY OTHER KNOWN TYPE"

(Not Injured by Static)

Type RJ4 $18.00

The **United States Bureau of Standards** states that it is fully 50 per cent. more sensitive than any other form of detector. No better authority could be quoted.

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Special No. 55
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2000 ohms $4.00
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Absolutely the most *sensitive,* the most *comfortable,* the most serviceable 'phones ever offered at such low prices.

GUARANTEED

to *equal* or *surpass* in every desirable quality, *any* 'phones that you can buy for many times the price.

TRY THEM

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The latest 1915 catalog of Murdock's apparatus is now ready. If it has not reached you, send for it today.

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POCKET WIRELESS PERFECTED AT LAST

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IN SIZES SUITABLE FOR
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SPECIAL SIZE 26" x 8" Dia.
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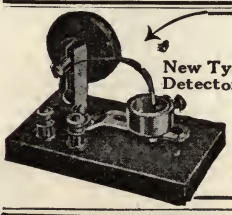

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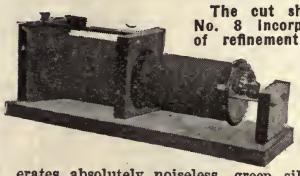

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To transfer your pictures to China, Leather, Watch Cases, etc., you only require

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Directions: Print from your negative on a piece of KIOGRAPH PAPER, strip off in water, fix in hypo and stick on the picture with the adhesive.

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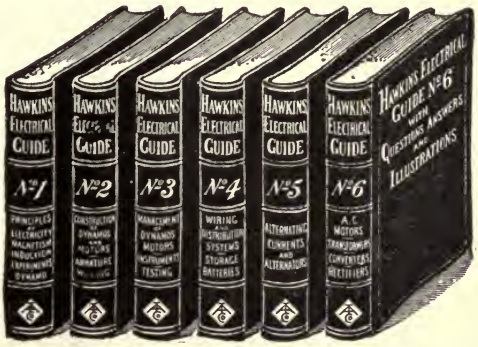

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Read over the titles shown on the back of each volume, and note the scope of each book. They are handsomely bound in flexible black leather with gold edges and will readily go in the pocket. THEY ARE NOT ONLY THE BEST, BUT THE CHEAPEST WORKS PUBLISHED ON ELECTRICITY.

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Ship at once, prepaid the 6 numbers; if satisfactory I agree to send you $1 within seven days and to further mail you $1 each month until paid.

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W. A July

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It's the only .22 repeater made with the dependable lever action—like a big game rifle. It has better weight, better balance, greater stability than any other .22. It's guaranteed in accuracy and reliability; handles rapidly. It gives 25 shots at one loading.

Model 1897 .22 Calibre Repeating Rifle

Shoots .22 short, .22 long and .22 long-rifle cartridges. For rabbits, squirrels, hawks, geese, foxes, target shooting, etc., no other .22 repeater equals this *Marlin*.

It's a take-down rifle, easy to carry and clean. Has tool steel working parts that cannot wear out. Beautiful case-hardened finish, splendid sights, and the famous *deep* Ballard rifling.

The solid top and side ejection mean safety and rapid, accurate firing. It's the *up-to-date* construction.

This rifle **costs more** because made better; **it hits** where others miss; built to last a lifetime. With round barrel $14.50; octagon $16.00. Other .22 repeaters from $9.25 up. Send 3 stamps postage for big catalog of all *Marlin* repeating rifles and shotguns.

Do it now! Select the *one best* gun!

Marlin

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in "Midget" size has a distinct appeal to you as a Lodge or Society member. Beautifully designed, unobtrusive, yet its quiet dignity emphasizes its exclusive function. Inserted at the extreme point of lapel and tightly screwed on. Solid Gold—50c. each.

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Will shave just as clean and comfortably as the high-priced razors. Nickel plated holder and handle. First class steel blade. Per gross, $6.50.

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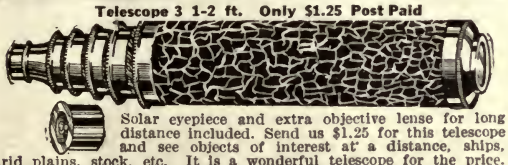

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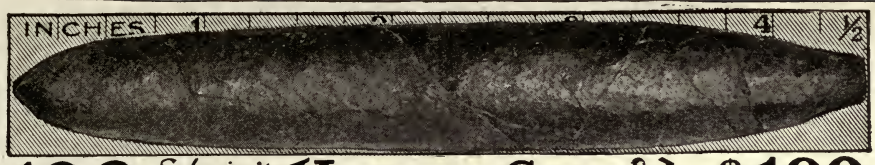

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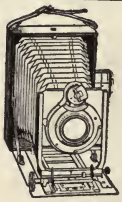

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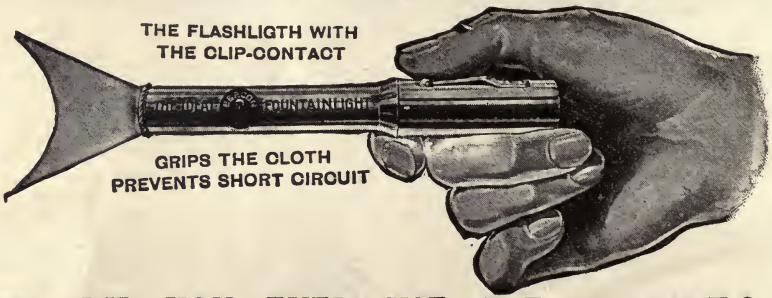

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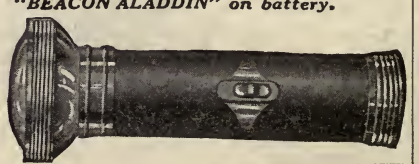

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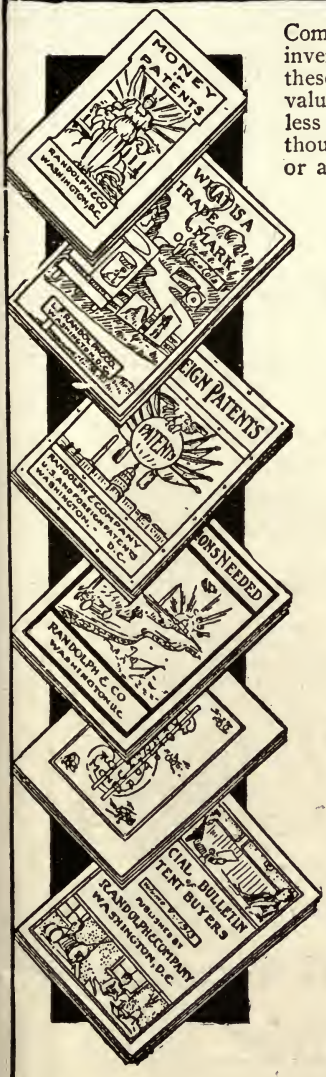

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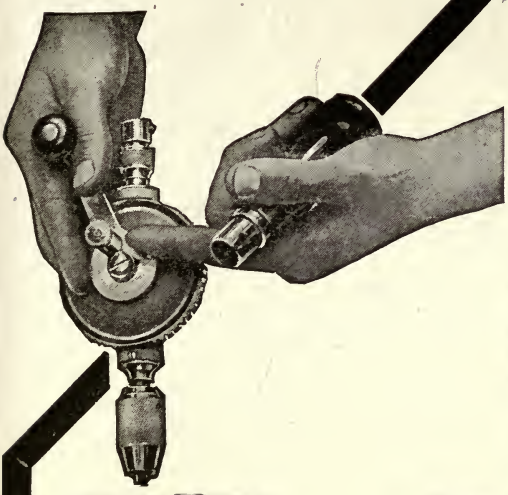

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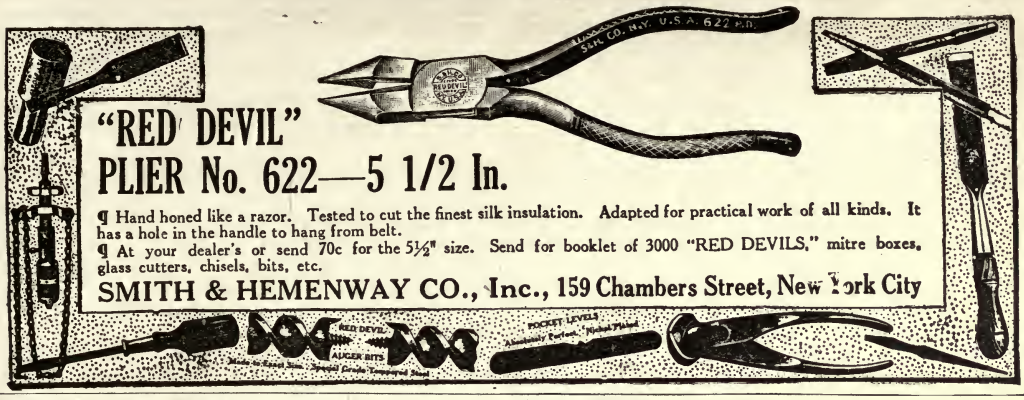

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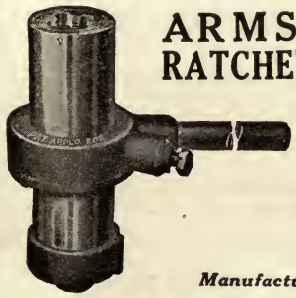

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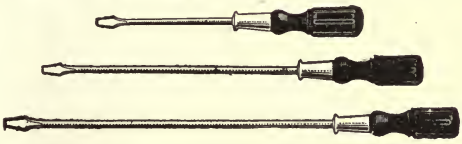

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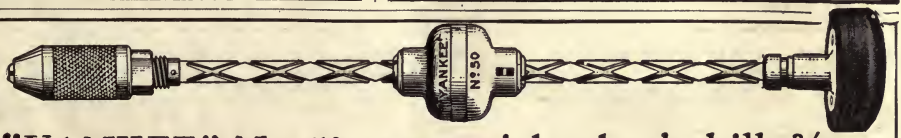

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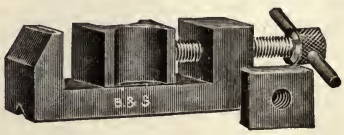

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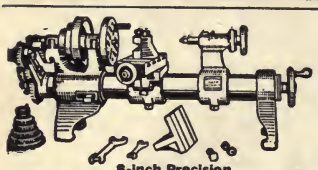

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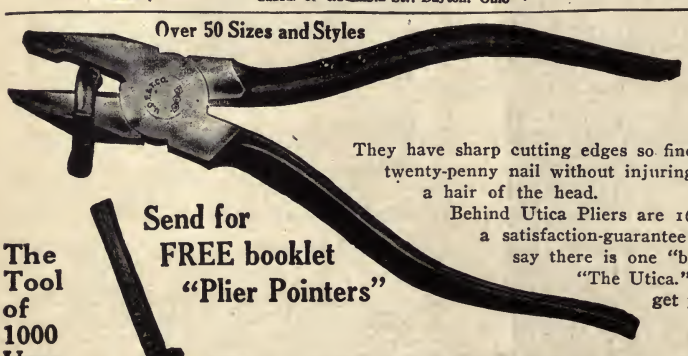

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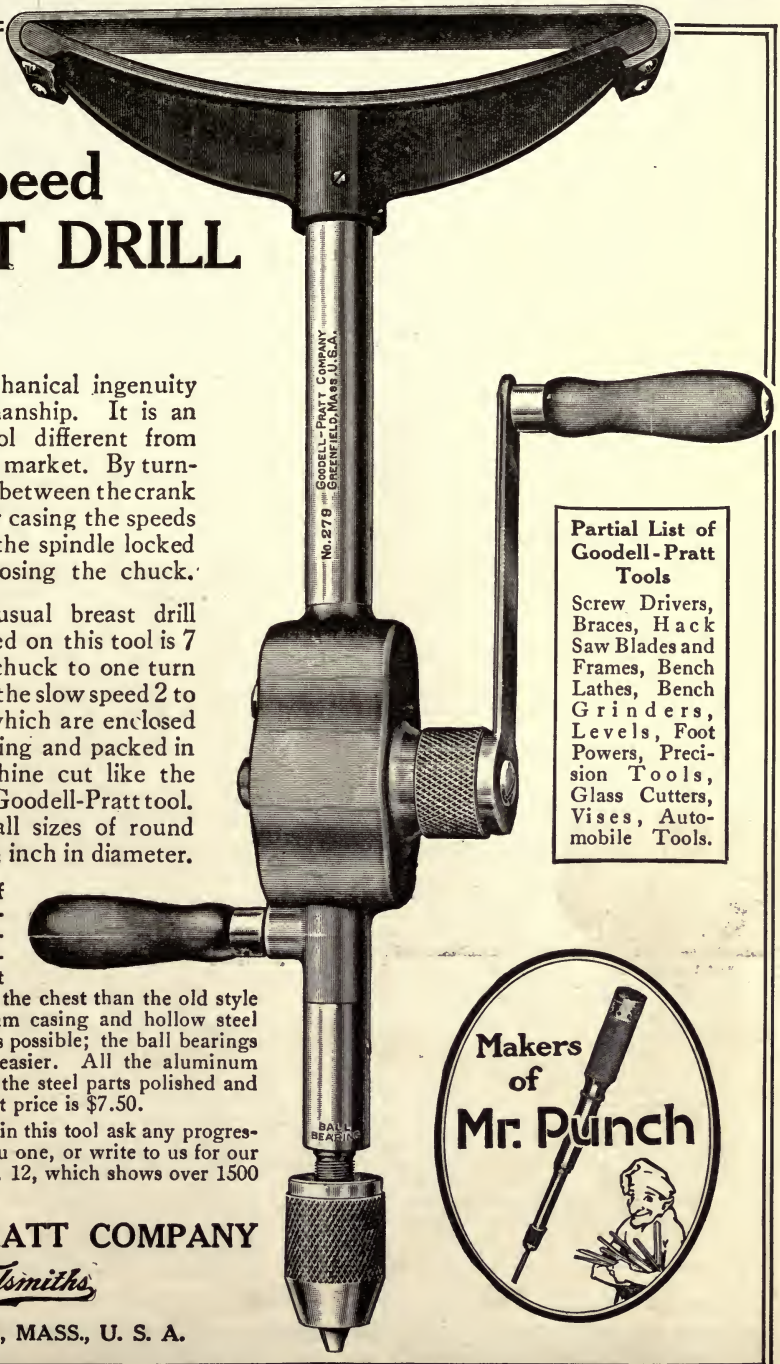

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The World's Advance

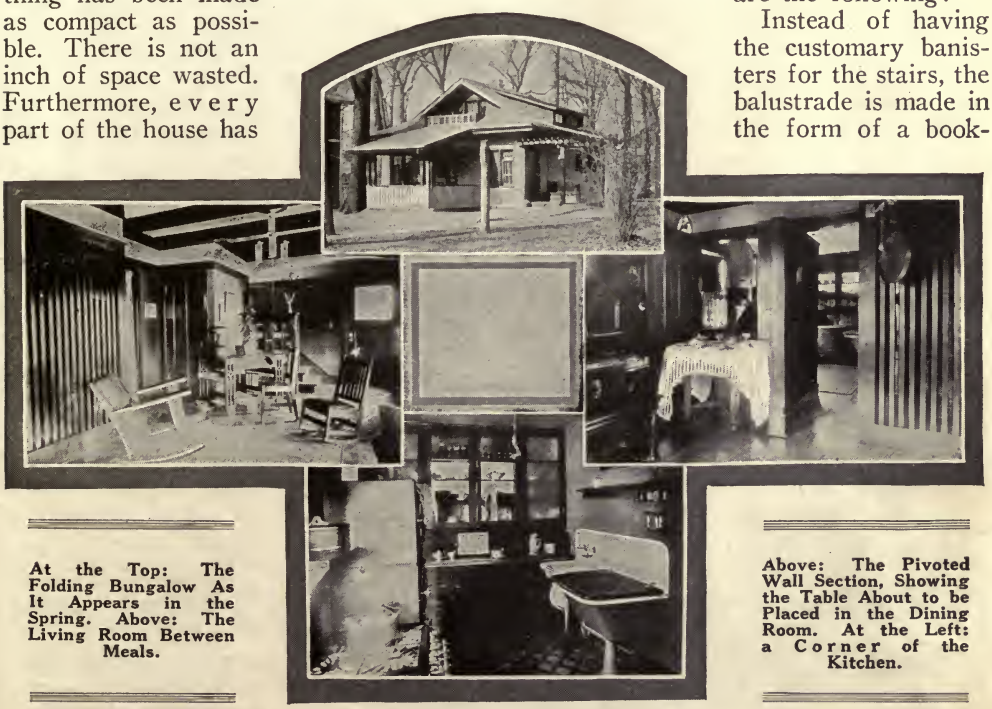
Vol. 31 JULY, 1915 No. 1

A FOLDING BUNGALOW

MUCH ingenuity and originality have been displayed in a small bungalow home designed and built by a Chicago chemist. In this home everything has been made as compact as possible. There is not an inch of space wasted. Furthermore, every part of the house has been designed so as to reduce the work of housekeeping to a minimum .yet afford the utmost comfort to its owner.

The bungalow was built in six weeks' time, on a foundation of concrete covered with stucco, the total expense amounting to only $2,000. Among the most prominent features of this dwelling are the following:

Instead of having the customary banisters for the stairs, the balustrade is made in the form of a book-case. The walls of the living room are pivoted so that it may be converted into a dining room by merely turning them around. The dining table is kept in the



At the Top: The Folding Bungalow As It Appears in the Spring. Above: The Living Room Between Meals.

Above: The Pivoted Wall Section, Showing the Table About to be Placed in the Dining Room. At the Left: a Corner of the Kitchen.

kitchen until it is set and the meal is ready. It can then be brought into the living room at the time the walls are being turned. The different courses are kept in drawers until needed. The same drawers are used for keeping the soiled dishes until they are washed. At the conclusion of the meal, the walls are again turned and the table and dishes automatically placed in the kitchen.

Aside from the foregoing features there are many other less prominent innovations incorporated in the house. The heating system is quite remarkable and can be operated very economically. While the bungalow offers every possible comfort, it is so cleverly designed that its upkeep is within the means of those with moderate incomes.

TINY ELECTRIC TRUCKS HANDLE HEAVY EXPOSITION FREIGHT

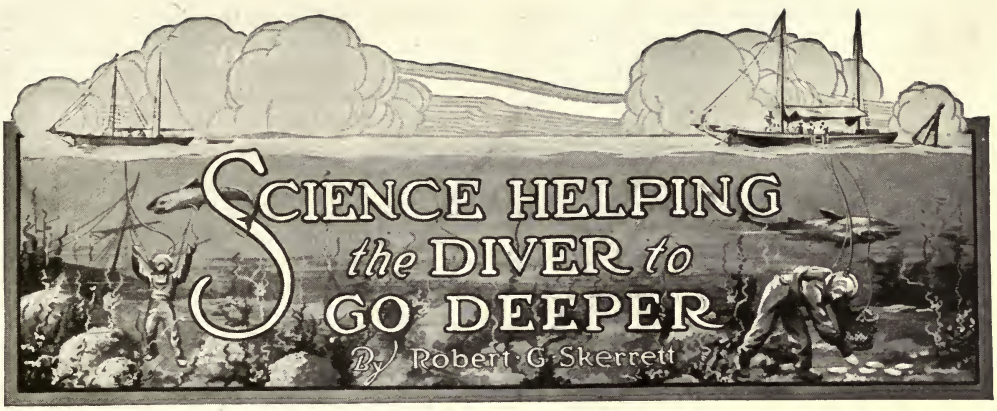
The heavy freight at the Exposition grounds in San Francisco, such as machinery, displays of manufactured articles, furniture, and cases of foreign exhibits, has all been handled by ten small but powerful electric trucks. These trucks are operated from the rear end, one man usually serving both as driver and unloader, and not only extremely heavy loads, but remarkably fast time has characterized this manner of handling the freight. Five to eight hundred tons daily has been the capacity of this unique system of distributing the incoming exhibits from the steamers and trains to the exhibit palaces and state and national buildings. The accompanying illustration shows one of these electric trucks carrying a large and heavy log up an incline to the exhibit of the State of Washington, which is in the Agriculture Building. The trucks handled nine carloads of these logs in 13½ hours. This illustrates the efficiency of modern methods of freight distribution by a system of trucks which take up very little room and can go through small spaces.

Ten Small Storage Battery Trucks Have Been Handling the Heavy Freight at the Exposition Grounds.

FLAMELESS HEAT

It is reported that an English scientist and investigator has hit upon a manner of gas heating that may greatly change our methods of using fuel. When a mixture of gas and air under high pressure is directed against a red-hot firebrick held a short distance away, the mixture will burn at the surface of the brick. Now, if such a mixture of gas and air is forced through the porous brick, and lighted on the farther side, it will burn like an ordinary gas flame; but if more air or less gas is used, it ceases to burn, but the porous surface becomes white hot. In that way it is possible, with great economy of fuel, to get a temperature far above the melting point of platinum. This flameless heater has been used for heating boilers. It is claimed that it will do away with grates, smokestacks and chimneys, that it produces no smoke or objectionable odor, and that it utilizes 90 per cent. of the heat value of the fuel.

A Pennsylvania electric power company is contemplating the installation of wireless telephones for insuring communication between their power houses and substations at all times. These scattered points are now joined by regular telephone, and the radio sets are to be used in emergencies.



DEEP-SEA diving and, in fact, all submarine operations have a subtle fascination for the average person. Perhaps the reason for this is found in the mystery surrounding such operations due to the fact that the layman is not privileged to witness the work. The author of this article gives the reader an insight into the more recent advances made in the art and tells how science is enabling the under-sea worker to operate at depths dreamed of but unrealized in the past.

WE are learning more every day about this supposedly familiar physique of ours; and the thing that seemed impossible for our bodies to endure yesterday is in a fair way to become the commonplace of tomorrow.

Not long ago a chief gunner's mate in the United States navy descended to a greater depth in the sea than any other man has yet gone and returned alive! The average of commercial divers do not go deeper than 150 feet, and two diving experts of the British Navy a few years ago established a record when they went down 210 feet in a land-locked harbor on the Scottish coast. The champion diver of our navy made a submergence of 274 feet!

This astonishing performance rests upon the results of certain investigations carried out by the Deep-water Diving Committee of the British Admiralty some time ago, together with additional experience gained here by experiments made in our own service. Until recently, the naval diver qualified for his work here by showing his capability to operate at a depth of 60 feet, and the men have been seldom called upon to work at a depth of 100 feet. And yet the Navy Department announces that it is believed that divers henceforth can do useful work 300 feet below the surface of the sea and without the danger due to the physical stresses imposed at such a submergence.

With the millions of dollars worth of valuable materials carried to the bottom every year in sinking ships, and many of these resting on the sea bed at depths not exceeding 200 feet, this promise of capacity to work at 300 feet and the actual record performance of a descent to a depth of 274 feet open up alluring prospects in the way of salvage undertakings.

A Diver Taking a Sample of Air from His Helmet in Order to Determine the Amount of Carbonic Acid Present at Varying Depths.

Why has it taken so long to make this possible? Or, rather, how has the human body thus suddenly acquired new powers of endurance? Let us go back to the investigations conducted by the British Admiralty's Committee.

The researches were inspired by a number of deaths among the seamen divers in the Royal Navy, and what made the losses more distressing was that the men seemed to be alright for a period after returning to the surface and then keeled over and died without any apparent reason. There was a reason, but its identity had not been clearly determined previously; so the scientists of that committee set out to unravel nature's puzzle. And we shall see how vital a part animals played in the preliminary experiments leading up to certain amazing tests in which some of the investigators subjected themselves to abnormal and hitherto unreached pressures.

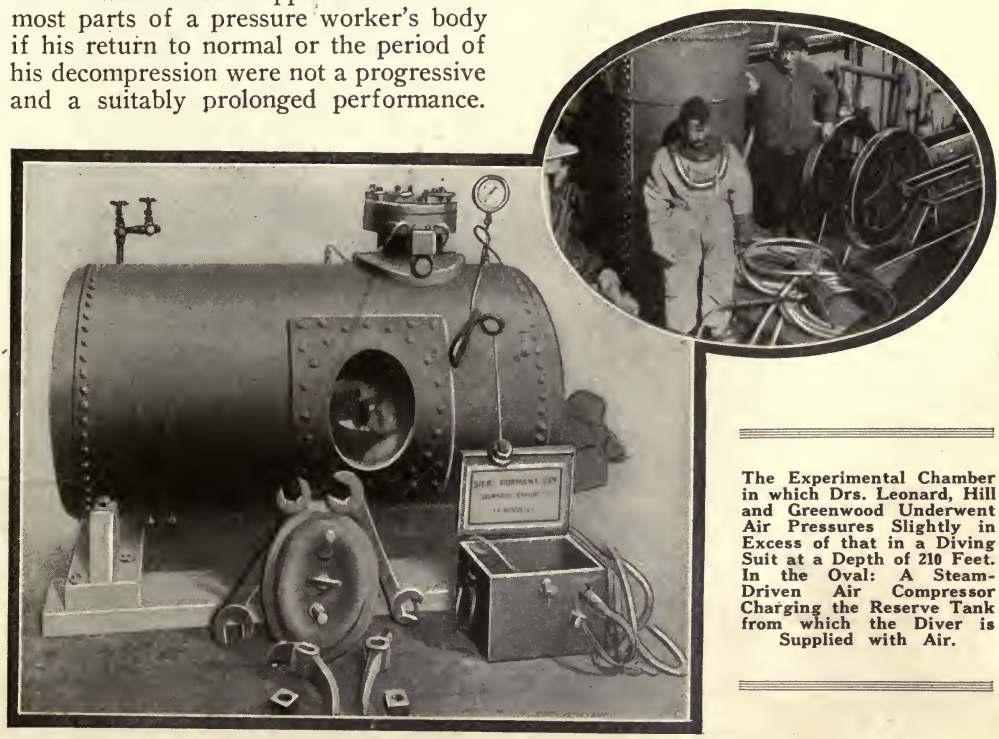
First the physicians studied the effects of increasing air pressure upon small animals, such as rats and mice and rabbits and guinea pigs, and, at the same time, watched their antics or what happened to them when the pressures were suddenly reduced to the atmospheric normal. From these investigations something was learned, but the data was inconclusive and the causes not definitely established. Accordingly, it was then decided to use larger warm-blooded creatures which would enable the researchers to arrive at more pronounced quantitative results, and for this work they chose goats. These larger mammals furnished the exact information needed, and then the physicians themselves did not hesitate to go into a testing cylinder and submit to air pressures corresponding to those called for in a diving suit when submerged at depths of from 150 to 210 feet in the sea.

The air we breathe contains nearly 80 per cent. of nitrogen, and this is the element in the atmosphere that endangers the pressure worker primarily, and it exerts its hurtful tendencies after the diver or the "sand-hog" has returned to the normal air. Bubbles of nitrogen develop in the tissues, in the smallest of the blood vessels, in the fluids of the joints, and in the nerve substances. These bubbles either interrupt circulation or cause pressures—the first leading to asphyxiation and stoppage of the heart, while the latter produces paralysis or the lesser evil commonly termed "the bends." Now these bubbles do not evolve within the body while it is undergoing pressure, nor do they usually manifest themselves during the stages of decompression, but they betray their presence by various symptoms when the pressure upon the diver or the caisson worker has been relieved. The effects may not be felt until many hours later.

The blood in our bodies does not make a complete cycle to every part of our physique in the same period. It penetrates much slower into the tissues and parts fed and drained by the tiny capillaries, and, in turn, it flows from these remote sections of our anatomy with corresponding sluggishness. The active arteries and veins, on the other hand, absorb faster and give off more rapidly the elements of the air breathed, and, therefore, respond more speedily to the rise or fall of external pressure. Now what happens? The capillaries and the tissues fed by them lag in reaccommodat-

ing themselves after a diver or sand-hog has been at work, and it is this lag that was not properly considered until a short while ago. This tardy action on the part of the tiny blood vessels is the real reason for peril to the pressure worker.

When the sandhog or the diver is decompressed too rapidly, especially in the final stages, nitrogen remains in the out-of-the-way regions of the body and has a pressure then in excess of that of the far more active arterial and venous systems, and is also greater than that of the external atmosphere. You have seen bubbles liberated in charged water when the cork was removed. In a general way that is what would happen in the innermost parts of a pressure worker's body if his return to normal or the period of his decompression were not a progressive and a suitably prolonged performance.



The Experimental Chamber in which Drs. Leonard, Hill and Greenwood Underwent Air Pressures Slightly in Excess of that in a Diving Suit at a Depth of 210 Feet. In the Oval: A Steam-Driven Air Compressor Charging the Reserve Tank from which the Diver is Supplied with Air.

Once developed, these bubbles may press against a nerve center and produce paralysis or they may get into the circulation, reach the heart, and induce death. Strange to say, the investigators found out it was not so much the great air pressure within the diving suit that caused the trouble, but rather the after-effects if the surcharged nitrogen were not properly drained from the capillaries and the tissues lying beyond the immediate flood of the active blood circulation.

But don't conclude from this that a man can breathe air at high pressure without running a risk. The worker must have an increased percentage of oxygen, and oxygen consumes the tissues, and if exposed to this attack too long a man would be poisoned by the very excess of this life-giving element under pressure. Therefore, a limit is thus imposed upon man's venturing into the ocean's depths, even though slow decompression when rising toward the surface would save him from the baneful effects of the nitrogen contained in his body.

Now another thing that has to be taken into consideration in diving operations in the ordinary elastic suit is the accumulation of carbonic acid gas—this poisonous element increasing directly with the amount of physical effort made by the deep-water worker. This gas is heavy and can be cleared from the metal helmet only provided the circulation of air be abundant and the pressure of it a trifle in excess of that of the water outside into

which it is exhausted. Now our naval authorities have introduced a modification. The British investigators found that most of the air pumps for divers were quite incapable of giving them the full and abundant supply needful when working at depths of 150 feet and more. The exhaust from the helmet was apt to be too feeble to take up and drive out the gathering carbon dioxide exhaled by the diver. In order to offset this danger and to make the diver independent of toilsomely-driven hand pumps, a steam or electrically-operated compressor was employed and the air stored in a suitable reservoir.

The diver's air tube was connected to this tank with a reducing valve interposed—the tank being charged at a pressure considerably in excess of that required at the operating depths. In this way, the underwater worker had complete control of his air supply by simply turning the little valve in front of him on his suit, and the people on the tender had only to see that the tank was kept duly loaded. Another innovation is the hospital or recompression lock. As you possibly know, the caisson workers on the shore now have a hospital lock where they can undergo recompression and then decompression after coming out from their underground chambers, but this has not been applied until recently to the working facilities aboard a salvage craft.

Ordinarily the diver is brought up to within about 50 feet of the surface and then slowly raised at intervals, covering a decompression period of an hour, possibly, if his submergence has been long and the depth great. In cold water, this is exhausting and adds just so much to the bodily drain already made by his operations on the bottom. To overcome this, a recompression chamber or hospital lock is now utilized, and instead of holding the diver in the chilling water and decompressing him there, he is brought up at a safe speed to the surface and hustled right into the lock where the air pressure is raised to a suitable point. There, his diving dress is removed and dry and warm clothes are put on him, and a cup of beef tea or something of the kind given him. All the while the pressure is being systematically lowered and he is able to talk with the attendant and to relax and rest. In this manner the safety of the diver is looked after as was not the case until latterly, and, at the same time, it is found that these deep-water workers can do more than was previously believed possible. Undoubtedly, divers will soon be able to descend to depths of 300 feet, and this is getting close to the 400-foot submergence which the English scientists declared would be possible provided the diver remained there only a short while. The human body is astonishingly adaptable. The only thing is how to humor it and what must be done to avoid abusing it.

WHALE CUTS OFF SUBMARINE CONNECTION

A short time ago the cable connection was suddenly cut off between Skagway and Juno, up in the Fairbanks district of Alaska, and for some time the trouble could not be located. At last the cableship Burnside found what was wrong. In some inexplicable way a large whale had become entangled with the cable, and the divers from the cable-ship found him with a half-hitch of the cable around his head and lower jaws. They removed the dead whale and re-established the connection by mending the break in the cable.

ARMORED CAR THAT CAN BE DRIVEN FROM EITHER END

Because it is sometimes necessary for an armored motor car to be taken quickly out of a tight corner or narrow lane when it is in action, the designers of the protected fighting autos of the Eaton Motor Machine Gun Battery in the Canadian army have struck upon the original and unique arrangement of having a second steering wheel and an auxiliary set of clutch and brake controls at the rear end of the cars so that the machines may be driven backward as easily and as speedily as in the forward direction. A mechanical difficulty lies in the fact,

To Allow Greater Flexibility of Action, Recent Canadian Armored Automobiles are being Fitted with a Double Set of Controls.

however, that the engines cannot be driven backwards or reversed for long periods because of over-heating on account of the positions of the radiator and cooling fan. The arrangement permits a car to be quickly withdrawn when necessity arises, after which it can be turned around. There are forty armor-plated cars in this battery and the accompanying illustration shows one of the motor vehicles stripped of the "fighting top" for an examination and test. Space is provided in the center for accommodating the machine guns and gun crew. The motor trucks are very rugged, to stand the most severe conditions.

HOW A MILITARY RIFLE IS LOADED

The accompanying illustration shows the Turkish and Spanish Mauser—used also in this same form in Mexico—as well as a clip or charger of modern ammunition ready to be stripped into the magazine. The hand of the soldier is clasped around the rifle, while the thumb presses downward on the top cartridge. The five cartridges are pressed out of the brass clip or charger, which is held in the slots in the rifle frame, until the last cartridge—or the top one as they are shown—is caught by the lip of the magazine.

The forward motion of the bolt drives the clip off the rifle and it falls to the ground. The bullets are the modern sharp point or spitzer type, used by most of the foreign armies as well as that of the United States.

The rifle can be opened, a clip of five cartridges inserted, the rifle closed and one shot fired in less than four seconds by a skilled man. To load the clip of five takes but a trifle longer than to slip one cartridge into the old style, single shot rifle, and so a rapid and continuous fire is afforded.

The French rifle uses a tubular magazine parallel with the barrel and holding eight cartridges. As it is not clip loading, it is very slow to recharge. The British rifle, unlike the Mauser, holds two of these clip loads of cartridges, or 10 in all, but is loaded from the clip like the Mauser.

A NEW DESIGN OF ELECTRIC SWITCH

A recently patented switch presents a new idea of interest. The fuses of the switch are so arranged that it is only possible to gain access to them after the current has automatically been turned off. Another feature of the invention is that the switch is so arranged that only authorized persons can reach the live terminals. The first feature of the device is of importance, since, if a short circuit exists on a line, it is not possible for a person to be burnt while inserting the fuses.

A Mauser Rifle and a Clip of Ammunition Ready to be Inserted into the Magazine. The Clip Method of Loading is Used in Most Military Weapons of Today.

The Return of a Motorcycle Club that Made the Ascent of Mount Wilson, Calif.

MOTORCYCLING A MILE HIGH

The modern high power motorcycle is adapted to mountain climbing as well as to pleasure trips on the easy valley grades. The adjacent view shows the return of a motorcycle club that made the ascent of Mt. Wilson, California, a peak more than a mile high, over a nine-mile road that has grades of from 14 to 28 per cent. This narrow and winding road is considered quite difficult for automobiles, but the motorcycle party made the ascent without trouble, many of the machines carrying two passengers.

THE WORLD'S GREATEST DREADNOUGHT

The United States battleship *Pennsylvania,* recently launched at Newport News, is greater in size and gun power than the famous *Queen Elizabeth* of the British Navy, which has figured so prominently in the operations against the Turkish defences at the Dardanelles.

The main battery of the *Pennsylvania* consists of twelve 14-inch guns set in four turrets, there being three guns to the turret. This is the plan of big gun arrangement which has been employed in the sister ships which preceded her, the *Nevada* and *Oklahoma,* each of which has a tonnage of 27,500, as against 31,400 of the *Pennsylvania.* In these three ships, as well as in the case of the *Queen Elizabeth,* all the turrets are on the center line, so as to concentrate their fire on either broadside.

According to well informed experts, the *Pennsylvania* will be able to hurl seven and one-half tons of steel on either broadside from her enormous main battery upon pressing a single firing lever. In addition to this, the battleship will have a secondary battery of twenty-two 5-inch rifles for defence against torpedo boats and submarines.

The interior furniture of the *Pennsylvania,* including wardrobes, berths, dining tables, chiffoniers, bureaus, toilet cases, book cases, desks and office furniture, will be made of art metal. The ship's complement will consist of 65 officers, 863 bluejackets and 74 marines.

The trials of the completed dreadnought are set for November, 1915. The finished craft will cost about $13,000,000.

TAKING THE CHILL OUT OF THE MORNING BATH

The chill of the morning bath is no longer to be dreaded, because a device has been perfected that absorbs the shock and leaves only the exhilaration of the plunge. The new device is known as the rowing bath, because in its operation the muscular activity occasioned by rowing is

The Chill and Shock of a Cold Bath are Removed by this Helpful Form of Exerciser.

closely simulated. It is exceedingly simple, consisting of a tin scoop with a capacity of a half gallon and a loop of stout rubber tubing which can be attached instantly to any bath tub.

To operate the rowing bath, the bather seats himself in the tub, throws the rubber loop over the faucet of the tub and turns on the cold water. As it pours into the tub he scoops it up in generous quantity and dashes it upon his chest. Because of the resistance offered by the rubber attachment, the muscular effort may be made as easy or as difficult as one desires, and it is easily possible to work up generous perspiration even though the temperature of the water is low enough to be uncomfortable were the bather absolutely idle.

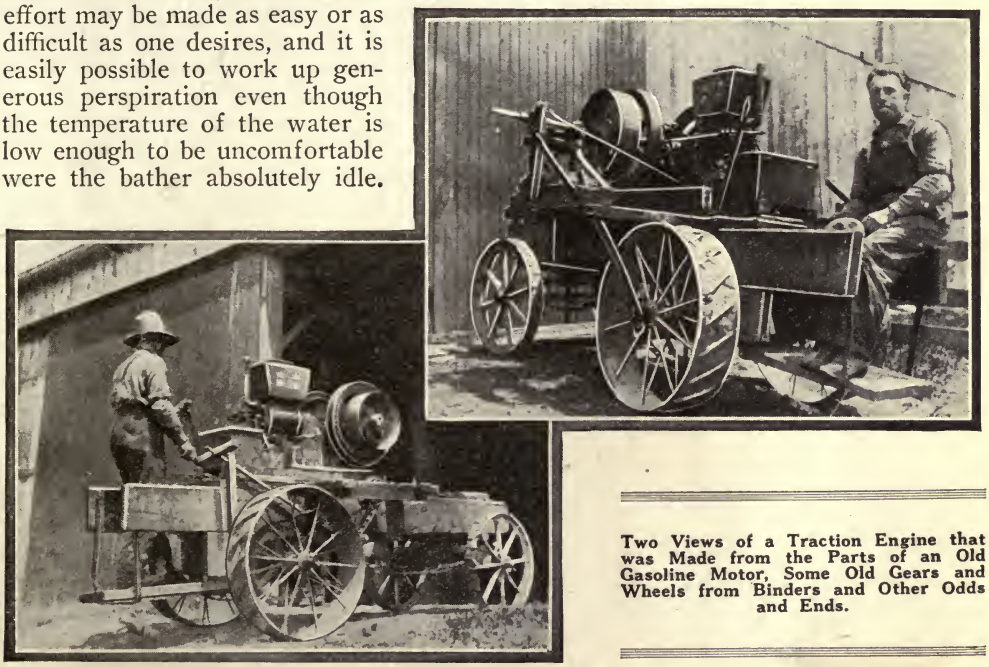
PERFECT TIMEPIECES

An astronomical clock must keep more nearly perfect time than any other instrument. The makers of such clocks must consider how much effect slight changes in the temperature and in the pressure of the air will have upon the oscillation of the pendulum. There have been prepared elaborate tables that show the weights of dry and moist air at varying temperatures and atmospheric pressures.

There is a Riefler clock at Potsdam in which virtually all the influences that affect the swinging pendulum, no matter how minutely, are compensated for. The pendulum of this astronomical clock swings with such precision that after 576,000,000 seconds (more than eighteen years) the error of the clock is only one second.

A HOME-MADE TRACTOR

A traction engine made from parts of an old gasoline motor, some old gears and wheels from binders and other odds and ends found in a barn, is used by a young Canadian farmer to do the chores of his neighbors within a radius of several miles of his home. The motor is connected by chain drive to the two rear wheels, and on a good road the tractor can move at a comfortable speed. Its construction, although crude and cumbersome, is quite ingenious.



Two Views of a Traction Engine that was Made from the Parts of an Old Gasoline Motor, Some Old Gears and Wheels from Binders and Other Odds and Ends.

Mr. Dempster, who was probably the first man to ride a bicycle in England and who was also a distinguished electrical engineer and scientist, died recently at Schenectady. It is claimed that he also built the first commercial telephone in England in 1876.

CEMENT AND CONCRETE ABOUT THE HOME

CEMENT and concrete, although extensively employed for various building purposes, are not used as extensively as they might be around the home. These materials should be more frequently employed for different structures about the farm as well as the city dwelling, since they practically cut down the cost of living in that they eliminate a great deal of work usually involved in erecting wooden structures. Furthermore, when once built a concrete or cement structure is serviceable for a lifetime.

A few examples of the best manner in which to utilize concrete and cement about the house are shown in the illustrations on the facing page. One of the most important of these is perhaps the incubator and brooder house, made of monolithic reinforced concrete; the walls, roof and floor forming one solid mass. The roof is reinforced by electrically welded fabric, consisting of No. 3 wires and having a mesh of six inches. The roof is three inches thick, while the walls are four inches thick and have ½-inch steel reinforcing rods which run both vertically and horizontally. The floor, of course, is solid. The entire shelter is built on the Spanish style of architecture and has a cement awning covered with red tiling along its entire front.

THE VIEWS APPEARING ON THE OPPOSITE PAGE ARE AS FOLLOWS:

(1) Incubator and Brooder House Made of Reinforced Concrete. (2) Attractive Concrete Pergola which Forms the Porch of a House. (3) An Incinerator which is Used for Burning Rubbish of All Kinds. (4) Attractive Flower Box Made of Cement. (5) Flower Pot of Artistic Design. (6) A Motorcycle Driveway. (7) Sun Dial Made of Cement and Cobblestones. (8) Hitching Post of Concrete which has been Given a Bark Finish. (9) Concrete Chicken and Duck House. (10) Cement Clothes Pole. (11) Cement Floor Under a Grape Arbor. (12) Cement Wall Around a Croquet Ground.

The chicken and duck house has three walls and a roof, there being one open side and no floor. The walls are two inches thick, and the open side measures three by three feet. This shelter is sanitary, there being no cracks in which vermin can collect and breed, and cleaning is easily accomplished.

The private incinerator is a very interesting arrangement, mainly for sanitary reasons. It helps keep the home clean, since in it anything in the way of paper, vegetable parings or other refuse can be destroyed by fire. The incinerator is two feet in height and three feet in diameter at its base. Openings for draft have been left on opposite sides, while another opening of eighteen inch diameter is provided at the top. Through the latter the rubbish is introduced into the incinerator. The structure can serve still another purpose beside that for which it is intended. In summer time, when the house is to be kept as cool as possible, the hot water required for washing and other purposes can be heated over the incinerator in the open. This structure, together with the cement clothes pole, forms a useful as well as an ornamental combination for wash day.

The cement post, shown in one of the views, is solid and has received a sanded finish to match the house beside which it stands. It is seven feet high and tapers gradually from ten inches in diameter at the base to eight inches at the top. When near the top it narrows abruptly to the point upon which the cross arms rest.

Other interesting features in cement and concrete construction are the cement floor of the grape arbor and the floor of the enclosed wire cage, which is intended as a breeder of blooded cats. In the latter instance the cement floor prevents the cats from digging under the fence and escaping.

The motorcycle driveway is a clever innovation. It consists of a strip of cement, eighteen inches wide, running from the sidewalk in front of the house back to the garage in the rear. In this instance the driveway is eighty feet long. To modify it into an automobile driveway, it is only necessary to lay another strip of similar size a few feet away and parallel to the first one.

A cement croquet ground in the form

CLEVER APPLICATIONS OF CONCRETE AND CEMENT

of a cement enclosure wall is a practical application and can be very easily built. The wall is about twelve inches high and four inches thick.

A hitching post similar to that shown in one of the views can be made four feet in height and twelve inches in diameter, in one solid piece of concrete. The fastening ring may be located a few inches from the top and the surface of the post given a finish that resembles the bark of a tree.

Other structures in cement and concrete are the flower boxes, pergolas, flower pots in many unique designs, and a sundial to decorate the lawn. The latter can be made extremely attractive by using cobblestones which are held together by cement. The top slab, which serves as the dial, is two feet square and made of solid concrete.

The foregoing descriptions are offered in the way of suggestions and serve to illustrate the large number of ways in which cement and concrete may be artistically and usefully employed. Practically any one can make the simpler of the structures described, while the more difficult ones can be made after some practice.

A SALES GARDEN THAT BRINGS BUSINESS

Many stores, even in closely built retail districts of our large cities, maintain a fairly large rear court which is merely a catch-all for packing cases, rubbish, barrels and excelsior — a fire menace and a waste of immensely valuable space.

A Progressive Dealer has Materially Increased His Trade by Building this Attractive Resting Place, which was Formerly an Unsightly Back Yard.

In the heart of Los Angeles, in a section which is said to command a larger rental in proportion to the population than any other retail center, precisely such conditions exist. The accompanying view illustrates how one retailer managed to turn such a danger and waste into profits. The back yard, extending from the rear of the store to an alley, had almost the ground area of the store itself on which he was paying a fancy rental. On one side was the brick wall of an adjoining building; on the other, a high board fence. The entire yard was littered with rubbish; accordingly, the first step was to pay a man to remove it and to arrange for frequent removal of old cases and other waste.

A gardener was then employed to turn up the ground and apply fertilizer to the flower beds, and gravel to the walks which he laid out. A carpenter constructed a pergola of rough timber over the entire area, over which vines could be trained, while flower and fern baskets were hung from the beams. Ferns and exotic plants and flowers were set out, a tiny fountain constructed in the center, and comfortable benches and outdoor furniture placed where the patrons of the store could sit and enjoy the restful

surroundings. Even a few Navajo rugs were spread where their barbaric colors would brighten the corners. Then the public was invited to make a rendezvous of the garden, and the response was prompt. The store sold talking machines and records, so a noon-time concert was an attraction and a large number of sales resulted from placing the customers in pleasant surroundings and making them comfortable.

FEDERAL JURORS EAT CAKE MADE OF EGGS TEN YEARS OLD

Cake made of eggs ten years old was served to jurors in the Federal district court during the hearing of a suit brought against a former collector of the port of New York by an importer, to recover $12,000 damages because a consignment of Chinese preserved eggs in which he had an interest was destroyed as unfit for use. The eggs had been preserved by boracic acid in a solution, and tasted good to the jurors who ate them, despite their extreme age. A professor of biological chemistry testified that it is possible to keep eggs 100 years by this method without impairing their quality or taste.

A GASOLINE-OPERATED TAMPING MACHINE

One of the latest additions to the ranks of labor-saving machines is a tamping equipment that is operated by gasoline power. The machine not only does the tamping in a more efficient and expeditious manner than is possible by manual labor, but it also effects a considerable saving in the cost of work of this kind.

The tamping machine operates a 150-pound ram at the rate of forty to fifty 22-inch strokes per minute. Comparing the machine with manual labor immediately discloses its vast superiority. The average laborer with even a fifteen-pound tamper will not average more than twenty strokes per minute, and with a heavier tool the rate is proportionately less. Furthermore, he will hardly lift the tamper more than nine or ten inches. Not only does this indicate that the machine tamps down the ground in a more firm manner, but it also proves that the speed is far greater.

The Gasoline-Operated Tamping Machine is a Recent Addition to the Ranks of Labor-Saving Devices. It Does the Work of Several Men.

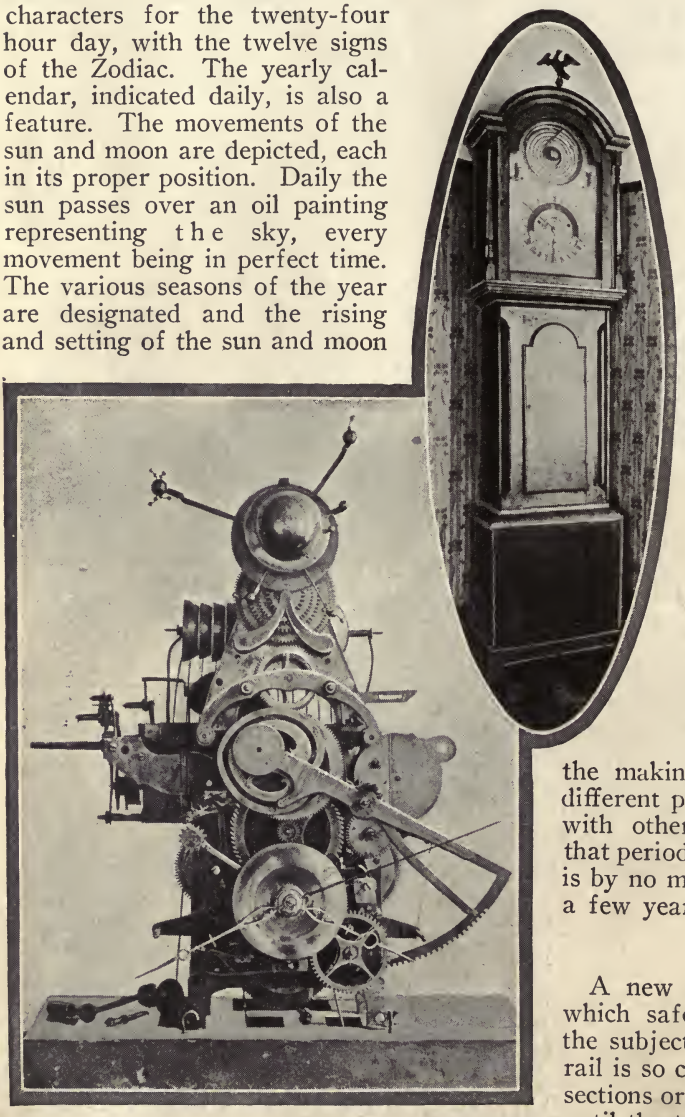
The tamping machine can travel about under its own power at the rate of eleven to thirteen miles an hour. When at work it travels forward or backward at a speed ranging from six to fifteen feet per minute. The motive power is furnished by a four-horsepower gasoline engine.

It is claimed that the tamping machine will replace from eight to ten men under favorable conditions, and even under the most adverse conditions, such as short jobs, it replaces anywhere from three to five men.

THREE-CENTURY OLD CLOCK KEEPS PERFECT TIME

After ticking its way through the ages from the seventeenth century, an unusual clock, imported recently from England to the United States by a native of Los Angeles, California, is still counting out the seconds and tallying off the seasons. This specimen, which is eight feet in height and two feet wide, is made of mahogany and has a large solid brass dial. The dial contains characters for the twenty-four hour day, with the twelve signs of the Zodiac. The yearly calendar, indicated daily, is also a feature. The movements of the sun and moon are depicted, each in its proper position. Daily the sun passes over an oil painting representing the sky, every movement being in perfect time. The various seasons of the year are designated and the rising and setting of the sun and moon during these changing periods may also be seen.

This unusual, mammoth timepiece shows the entire solar system, including Venus, Mercury, Mars, Earth, Saturn and Jupiter, each of these planets carrying its allotted moons and revolving around the sun. A novel feature is the comet which may be seen starting from the side of the dial, passing around the sun, thence back again to the side of the dial. The clock contains also a series of bells. At the close of each hour this queer orchestra plays a selection which was popular when the Stuarts were reigning in England. There are two ancient-shaped figures on the face of the dial which go to prove the antiquity of the clock. One of these is holding a telescope pointed to the dial representing the universe, while the other automatically beats time to the tunes played on the chimes. The name of Eva Falmouth is inscribed on the dial.



Although More than Two Hundred Years Old, this Clock is a Marvel of Mechanical Ingenuity.

In order to perform the various functions already mentioned, the mechanism of this clock must necessarily be quite complicated. And so it is, and no little ingenuity has been displayed in the making and assembling of the different parts. This clock, together with other clocks and watches of that period, proves that watchmaking is by no means an art that dates but a few years back.

A new design of third rail, for which safety is the main claim, is the subject of a recent patent. The rail is so constructed that its various sections or units do not carry current until the train is just about to make use of them.

A DRIFTING MINE'S VICTIM

THE SINKING OF THE BRITISH BATTLESHIP "IRRESISTIBLE"

IT was at the height of a terrific bombardment of the Turkish forts by the combined French and British fleets in the Dardanelles that the battleship "Irresistible" was sunk by a drifting mine. On the same day, March 18, a similar fate befell another British fighting ship, the "Ocean," as well as the French battleship "Bouvet." The crews of the two British ships were saved for the most part, but the "Bouvet" sank so rapidly that almost every man on board was drowned.

Photo. Copyrighted International News Service.

HOW DECEPTION IS PRACTICED BY BELLIGERENTS

French aviators have discovered the fact that guns painted in various colors are quite invisible at high altitudes and thus escape detection by the enemy's airmen. Accordingly, the French have painted their guns many different colors, as in the instance of this 75-millimeter field piece.

This improvised fake gun, consisting of a drain pipe, two cart wheels, a sheet of iron and other odds and ends, was used by the French during operations in the north of France. It caused the Germans to waste a considerable amount of ammunition in an effort to destroy it.

The British are providing bases for their hydro-aeroplanes at sea in a very novel way. They are employing steamers on which special landing platforms have been constructed. These ships are so painted that their outlines are not visible to the enemy. In this view is seen one of these steamers and its peculiarly painted hull.

Photos. Copyrighted International News Service.

IN THE TRENCHES AND AT THE REAR

Contrary to the general opinion that the Russian army is ill equipped, the accompanying view proves that the Slavs are not to be outdone by other fighting forces in the matter of materiel. Here is seen one of the many repair shops on wheels, which keep the aeroplanes, automobiles, motorcycles and other machines in perfect shape. These shops usually contain a lathe, drill press, planer and all kinds of hand tools. Some of them even have an oxy-acetylene torch outfit.

Above: King's African Rifles intrenched during a lively engagement in East Africa. In the oval: German transport wagons traveling over the Polish plains near Suwalki. In this view, as far as the eye can see, there are transport wagons, bringing food and war materials to the German lines. At the right: A remarkable line of trenches used by the Austrians in Galicia. The barricade in the water serves to partly conceal the trenches on the bank.

Photos. Copyrighted International News Service.

THE DESTRUCTION OF CIVILIAN PROPERTY

One of the many pathetic incidents of the war: An elderly woman returning to what was formerly her home in the northern provinces of France, only to find it in ruins. Homes have not been spared by the soldiers when they have been found interfering with the fighting. And in many instances the houses have been converted into strongholds by the soldiers during the house-to-house fighting in some of the French villages and towns.

Remains of bombs dropped by Zeppelins during a recent raid over the East Coast towns of England. These particular bombs are of the incendiary variety and are calculated to spread conflagration when dropped on the crowded houses of a town or city. Fortunately, the raids are made at night, and most of the bombs fall harmlessly into open fields, due to faulty aiming on the part of the airmen.

A house which was wrecked by bombs from a Zeppelin during a recent raid over English territory. In this instance an explosive bomb was employed by the airmen with telling effect. It is said that the Zeppelins are now carrying a larger and more perfected type of bomb than heretofore, and that the effects are consequently more to be dreaded than in the earlier raids.

Photos. Copyrighted International News Service.

INTERESTING GLIMPSES OF THE GREAT WAR

The novel projectile seen protruding from the muzzle of the gun is used by the French in cutting the barbed wire entanglements erected in front of the German trenches. The gun is fired in such a manner that the projectile falls amidst the entanglements, carrying a long cable with it. The soldiers then pull on the cable, and in so doing tear down the elaborate barbed wire defences.

The remains of a German monoplane that was brought to earth by accurate rifle fire. Every part has been consumed by fire except the tail of the machine.

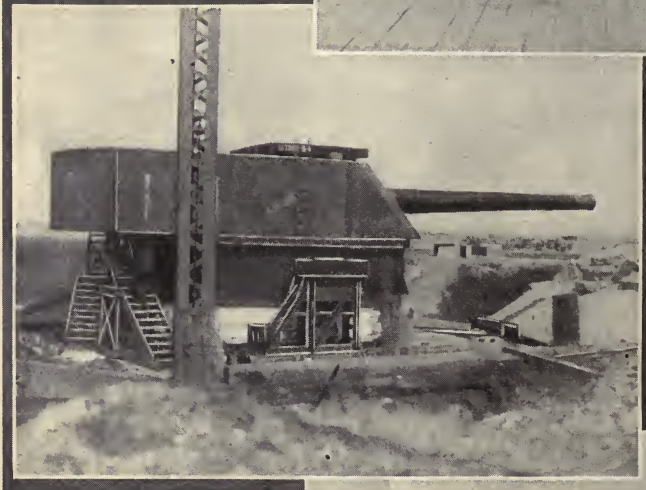
The prevailing spirit in the French army is that of good cheer, despite the many hardships and privations. For days at a time the soldiers have to live in water-filled trenches and suffer intense cold, besides being constantly in danger of death.

The British battleship "Queen Elizabeth," the largest fighting ship in the world, which has been taking an active part in the bombarding of the Dardanelles fortifications.

Photos. Copyrighted International News Service.

PEACE ACTIVITIES AND NEW DEFENSE GUNS

A delegation of prominent American and British women who sailed on the Holland-America liner "Noordam" for The Hague, Holland, to discuss peace measures. The party included Jane Addams of Hull House fame, Mrs. Pethick Lawrence, the British suffragette, and Mrs. L. Post, a prominent suffrage worker.



A fourteen-inch gun installed in a land turret at the Sandy Hook proving grounds where the turret is being thoroughly tested. The idea of using a turret for land guns is not a new one, but it promises to give greater combative power to coast defenses.

Members of the Regular United States Coast Artillery swabbing out a fourteen-inch gun. Should the tests of the land turrets prove them to be satisfactory, they will be installed in the various fortifications. By the use of the turrets the gun crews will have greater protection against hostile shells than at present.

Photos. Copyrighted International News Service.

DEATH-DEALING SHELLS AND TORPEDOES

A twelve-inch Austrian shell which fell inside the French fortress of Troyon and failed to explode. It is reported that of late many of the German and Austrian shells used on the western front do not explode, and that this is due to inferior manufacture caused by lack of necessary materials.

A German torpedo that was washed up on the shores of France. This torpedo was probably intended for a warship or merchant vessel but missed its mark, and after expending its motive power it drifted about until washed ashore

A huge hole in the hold of a German ship that was captured by the British and used in the Dardanelles operations. This hole was caused by a Turkish torpedo, and strikingly illustrates the explosive power of modern torpedoes. In this instance the hole was above the water line and the ship remained afloat.

Photos. Copyrighted International News Service.

INTERESTING WAR SCENES THE WORLD OVER

A storekeeper in New York collecting old gold and silver for the German government, giving to the Germans who turn in their jewelry and other valuables a certificate and an iron ring which bears the famous Iron Cross insignia. The money obtained from the old gold and silver is forwarded to Germany.

A Russian column passing through one of the main streets of Przemysl, the former Austrian stronghold in Galicia, which was captured by the Slav forces after an investment of several months. The Russians brought food into the city and relieved the suffering inhabitants who were famished.

A stock of barbed wire in the rear of the French lines. A great quantity of this wire is constantly being required because of the miles of wire entanglements that must be erected for properly protecting the intrenched positions of the French.

Russian soldiers placing notices in the streets of Przemysl announcing their occupancy of the town to the populace. A recent strong defensive movement by the combined German and Austrian forces has caused the fighting in Galicia to be carried back close to Przemysl. There is a possibility that it may again be besieged, this time by its original masters.

Photos. Copyrighted International News Service.

ZEPPELIN BOMBS AND GERMAN SHELLS

A hole in the roof of a home caused by a bomb dropped from a Zeppelin during a recent raid over England. Aside from the hole in the roof, the only other damage was a broken window. No one was injured.

A striking view of the clouds of smoke caused by bursting shells. This scene was taken in northern France during a recent engagement.

Another victim of a Zeppelin raid over the east coast of England. In this instance the house struck by the bomb was greatly damaged, although no one was injured.

The smoke toward the left in this view is caused by a bursting shell, yet the sheep do not appear alarmed at the noise of the detonation. The animals, as well as the men, near the battle front have become accustomed to the artillery fire and shells, and disregard them.

Photos. Copyrighted International News Service.

BRITISH MINE SWEEPERS AND THEIR CREWS

Two of the British mine sweepers tied up at their dock. These ships perform the important duty of clearing the mines from the waters surrounding the British Isles.

The crew of a British mine sweeper in the Dardanelles using rifles for the purpose of exploding floating mines.

The crew of a British mine sweeper. These men constantly wear life belts and life collars when performing their work, owing to the constant danger of the ship being struck by a mine. This little-heard-of branch of the naval service is perhaps the most hazardous calling of any of the enlisted men.

Photos. Copyrighted International News Service.

WITH THE SOLDIERS BETWEEN BATTLES

Austrian engineers repairing a bridge in the Carpathian mountains that was destroyed by the Russians. Here they are seen building a large column of timber for supporting one of the spans of the bridge. Below: Another view of the bridge

Below: A disinfector equipment used for infectious clothes and bedding at the Duchess of Westminster's Hospital in France. This disinfector is employed especially for the bedding used by patients having typhoid fever.

Below: French Colonial troops doing their own washing in the sea, at St. Raphael, on the Mediterranean.

Photos. Copyrighted International News Service.

WAR ACTIVITIES IN DIFFERENT LANDS

Above: Panoramic view of the Golden Horn, Constantinople. The warship at anchor is the former German cruiser "Breslau," which, in the early days of the war, escaped to the Dardanelles and was taken over by the Turks.

Above: British soldiers digging trenches in an Egyptian desert. At the left: A Serbian gun that was put out of action by Austrian fire during the bombardment of Belgrade. The dead gunners may be seen lying about the gun.

Mechanics making the final adjustments on a British military aeroplane just prior to its flight over the enemy. This view conveys some idea of the sturdy construction of the British flying machines. Not alone the machines but the pilots as well deserve considerable credit for their excellent work in the present war.

Photos. Copyrighted International News Service.

TOMORROW is the day of machinery; the man who works solely with his hands will soon be eliminated from the industrial world. Levers, cams and gears, made of brass, steel and other inanimate substances, are already replacing what was formerly considered skilled labor. Brains only cannot be replaced by the mechanical creations of man's ingenuity.

THIS page which you are now reading is the result of a large number of castings. It required 1936 moulds and eight pounds of metal to cast the perfect type faces which printed these two columns. Fifty-two times the brass moulds used in the work have been assembled in their proper order and molten metal poured into them so as to cast as many slabs of type—each slab being a single line of reading matter.

As complicated as the task may appear to be, its execution is a very simple matter—at least as far as the human element is concerned. An operator has simply to manipulate a keyboard with no greater effort than is required to operate the conventional typewriter, the different moulds dropping into place and the lines of type being cast without any attention whatsoever.

It is the great elimination of the human factor that has made modern printing so efficient and speedy. Take away the typesetting machines and our newspapers would not be what they are today. Neither would the magazines be as large and as moderate in price, for the cost of labor involved would be several times what it is at present. Due credit must necessarily be given the marvelous presses and binding machines now in use, but these do not concern us now.

The typesetting machine, of which there are two designs in general use—the linotype and the monotype—is a monument to man's ingenuity. It accomplishes a task which was considered impossible prior to its inception—that of setting up type by machinery. Any one who has watched a printer set the type by hand knows what the work involves. To begin with, the various pieces of type are placed in their proper order in a sort of holding device known as the "composing stick." After the printer has assembled enough words with spaces between them to make one line, his next task is to increase or decrease these spaces between the words in order that the type line will be of a certain width. All the lines in a printed column must

Each Line of Type Set on the Linotype Machine Consists of One Slab of Metal.

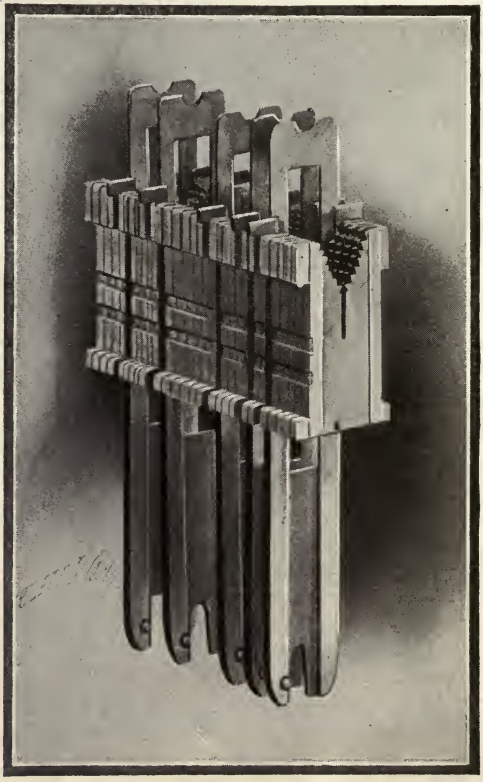
be of equal length: whatever difference there may be in the width of the type is compensated by spacing blocks between the words. This is known as "justification." Having accomplished the foregoing, the printer is now ready to clamp the type matter in a suitable frame and place it on the press.

Setting up the type and printing does not complete a printing job. There still remains another task for the printer to do. He must take the type out of the clamping device and place every individual type back in its proper place, so that it will be available for the next job. Obviously, it would be foolhardy to use the type but once and then discard it.

The typesetting machine was a necessity. It had to come. While typesetting by hand was practicable for small jobs, it was certainly unsatisfactory for large printing jobs such as newspapers and magazines. Not only was it exceedingly costly, but it lacked the speed which daily newspapers made imperative. Despite the many mechanical problems presented in evolving the typesetting machines, the ever-increasing demand caused it—one could say with impunity, forced it—to be invented and subsequently perfected.

The work of the modern typesetting machine is a two-fold one: it casts its own type and sets it up in proper order. And what is more, after the type has been used it can be thrown back into the melting pot of the machine and the metal used over again for the next job. Not only is it unnecessary to take up time in distributing the type, but fresh, clean, sharp type faces are available for each printing job when using the typesetting machine.

Let us examine one of the typesetting machines, the linotype, and study how it performs the various functions which are so human-like: In general appear-

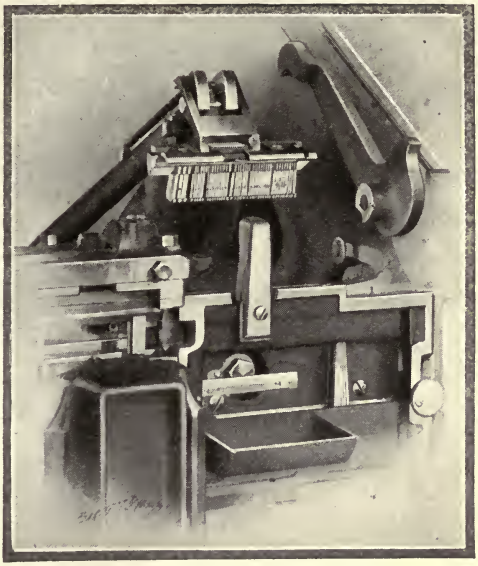


A Line of Matrices and Space Bands as they Appear When Assembled, Ready for Casting.

Single and Double Letter Matrices, Showing the Moulds and Teeth Combinations.

ance the linotype is a very cumbersome machine—and cumbersome it must be for the reason that its operation requires so many intricate and awkwardly-shaped parts. In front of the machine is a keyboard not unlike that of a typewriter, although somewhat larger and containing a greater number of keys. The operator sits before the keyboard and runs the fingers of both hands lightly over the different keys. As he presses them the little brass moulds or "matrices" are released from their respective brass channels and drop on a belt conveyor which carries them to the assembling mechanism. Between the words the operator presses a space bar which causes a steel wedge arrangement known as a "space band" to drop between the groups of matrices forming the words. A bell rings at the end of the line and the pressure of a lever by the operator causes the spacing between the groups of matrices to be automatically adjusted so that the line about to be cast will be of the desired length. The matrices and space bands are then transported to the mouth of the mould and an instant later a plunger pressing downwards in the melting pot causes molten metal to be forced into the mould and the matrices that cap it, the metal being soon cooled into a fairly smooth casting in the form of a slab with the type faces along one edge. Whatever irregularities there may be in the slab or "slug" are subsequently removed by trimming knives, after which the slug is delivered into a tray at the side of the operator.

The Casting Mechanism of the Linotype, Showing the Melting Pot, Plunger, Mouth of Mould and the Assembled Line of Matrices.



The Elevator Arm in the Act of Taking a Line of Matrices which are to be Carried to the Distributing Mechanism.

Meanwhile the operator has forgotten about this particular line and has been pressing the different keys for the next one. At the same time the matrices which have served their purpose are being taken care of. A long arm swoops down from the rear of the machine and picks up the row of matrices, leaving the space bands behind it. The latter are pushed over to one side where they are available for the next call. The matrices are carried upward to a screw conveyor arrangement at the rear of the machine and, one by one, started on a journey. As the different matrices reach a position above the opening of their respective channels they drop into place and are again ready for use.

The foregoing is but one cycle of operation of the linotype machine. The same steps are involved in the casting of each line. The operator keeps right on with his work and the machine automatically takes care of the justification of the lines, casting, trimming and delivery of the slug, and distribution of the

matrices and space bands. It is not uncommon for a machine to have one line of matrices in the act of being assembled, one line being cast and the matrices of a third line being distributed, all at one time. Each of the steps is independent from the others.

Two questions now remain to be answered: How are the lines automatically justified, and what causes the matrices to drop back in the proper channels? Here are the answers:

The brass matrices have a V-shaped notch, the sides of which are toothed. No two matrices have the same arrangement of teeth, for these correspond to the combination of ridges that run above the screw conveyor at the rear of the linotype. As the matrix with a certain combination of teeth reaches the corresponding combination of ridges, it is released and falls into the mouth of the channel below.

On the other hand, the automatic justification is even a more simple mechanical application, although strange to say it was the last problem to be solved in perfecting the linotype. The secret of automatic justification is found in the space bands, each of which consists of two wedge-shaped pieces held together. The wedge sides slope in opposite directions so that upon pressing the movable member upward the device spreads and becomes wider. The two outer sides are straight and parallel. Thus, when the matrices and space bands are assembled the pressing upward of the movable members of the space bands causes the spaces between the groups of matrices to be equally adjusted and to fill out the line.

As wonderful as the linotype machine is, it has a competitor in the monotype system which vies with it in mechanical ingenuity. The latter consists of two separate units—a keyboard and a caster—and its operation is as follows.

An operator presses the different keys of a keyboard in much the same way as in typewriting, causing a paper ribbon to be perforated with a series of holes, giving it the appearance of a piano-player record. The flashing and ringing of a lamp and bell inform the operator when the end of a line has been reached, whereupon he or she glances at the indicators on the machine, which indicate what keys to press in order to justify the line. After the operator has finished with his work, the paper ribbon is removed and brought to the caster.

The monotype caster is a type foundry in miniature, with its melting pot, moulds and smokestack for carrying away the lead fumes. As the paper ribbon passes through the mechanism of the caster the different pieces of type are cast and assembled on a brass tray in the proper order, line by line. Each type face is a separate block of metal as in handsetting. Between the groups of type forming

A Diagrammatic View of the Main Parts of the Linotype Machine, Showing the Various Steps in One Complete Cycle of its Operation.

A Typical Newspaper Composing Room, in which a Number of Linotype Machines are being Used to Set up the Reading Matter. Many Linotypes are required by Every Daily Newspaper, Because of the Vast Amount of Type Matter that Must be set up within a Limited Time.

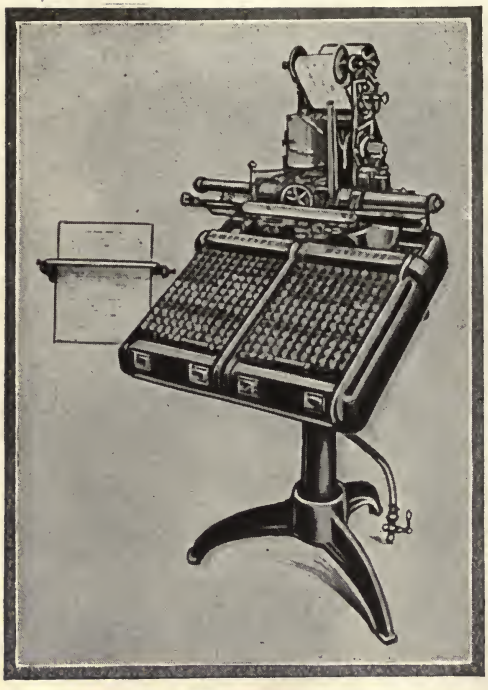
the words are inserted the spacing blocks of proper width, the size of these having been determined by the keyboard.

The mechanism of the monotype caster is not difficult to understand. Its moulds are quite different from the matrices of the linotype, for they are square blocks of brass with the intaglio letter at one end and a cone-shaped hole at the other. The moulds are assembled in a framework which is so mounted that it can be moved right or left and forward or backward. In all there are 225 matrices—fifteen on a side—held in the frame. Automatically the mechanism moves the matrices to bring the desired one in position above the mould, and then clamps it firmly over the mould; a pointed plunger pressing down in the cone-shaped recess of the matrix centers the mould and holds it in place. Compressed air passing through the holes in the perforated paper ribbon is the agent that moves the matrix frame, just as the same force operates the different hammers in a player-piano. When once the matrix is in position, the width of the mould is adjusted and molten metal then forced in from the bottom. It soon cools and is delivered on a brass tray in the form of a perfect type, along with its companions and spacing blocks that form the line.

The remarkable feature of the monotype machine is that the paper ribbon is a permanent piece of work, good for all time. It may be kept any number of years and then passed through the casting machine if the type is desired. Likewise, any number of times the type may

Matrices or Moulds of the Monotype Caster, Showing the Method of Holding Them in a Frame.

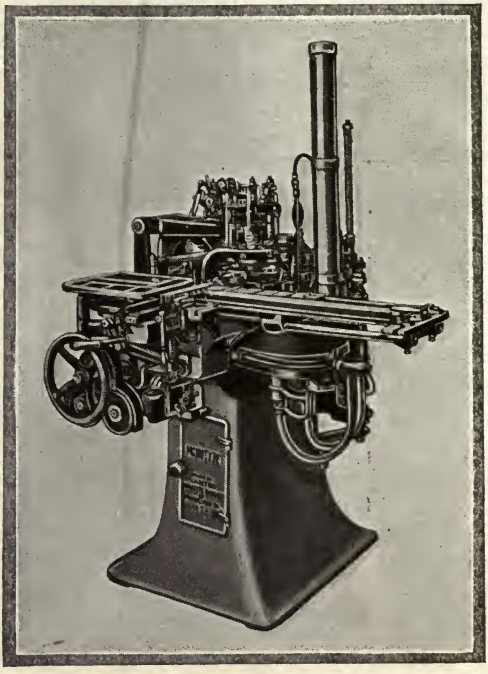
be set up in any size and style of type face by passing the ribbon through the caster as many times. And again, the keyboard, which occupies but a trifle more room than the conventional typewriter, may be used in any office or home, if need be, and the caster installed in a distant printing office. The records can be sent any distance through the mails and the type set up at some far-off point.



A Monotype Keyboard which Perforates a Paper Ribbon that is Afterwards Placed on the Casting Machine.

The linotype and monotype machines have their own individual fields and followers, as is the case with everything else. As a general rule, however, the former is largely employed for newspapers and magazines, while the latter is most popular in book and catalogue printing.

As in most other lines of industry, the human element is slowly but surely being eliminated from the printing trade. What was formerly costly manual labor has now been replaced by mechanical contrivances that invariably perform



A Monotype Caster which Sets Up the Type According to the Arrangement of the Perforations in a Paper Ribbon.

their tasks more economically and efficiently—and do not make mistakes. Truly, the day of the man who works with his hands only is limited—the competition of mechanical help is daily becoming more formidable. Machinery is bound to replace everything except brains.

INSPECTING A WELL

A novel method of examining the sides of a deep well is that devised by the superintendent of the water-works of a western town.

A well 1,400 feet deep was found to be yielding impure water. The superintendent ordered the pump to be removed, and, lowering a cluster of electric lights slowly into the well, he inspected the casing carefully with a fieldglass as the lights moved along. At a distance of 110 feet down, where the diameter of the casing diminished from 12 inches to 9, the packing was seen to be loose. The entrance of surface-water at that point was the cause of the trouble.

If you enjoy THE WORLD'S ADVANCE, tell others; if not, tell us.

MUNICIPALITY MAINTAINS "MOVIE" DEPARTMENT

A NEW use has been found for the motion picture—that of advertising a municipality. A motion picture advertising department has been made a permanent feature of the work of the Chamber of Commerce of Redlands, California, which probably is the first city in the world to establish and maintain a department of this character.

Purely as an experiment this motion picture advertising was put in effect about a year ago. At that time a special event held in the city was pictured and the results obtained by this picture being thrown upon the screens in that section of the country were so very remarkable that the promoters were persuaded to try something in this line on a larger scale. As a consequence, the citrus business, one of the largest industries in that city, was photographed from start to finish—from the planting of the trees to the packing and shipping of the ripened fruit. This necessitated about three reels of film and was quite an expensive feature, but, we are told, the returns were more than worth the expense and effort.

The method of exhibiting these pictures after they have been finished is of interest. The first move is to show them in the home town, giving each of the picture houses a chance at the pictures. After the home territory has been covered the pictures are shipped to the headquarters of the nearest motion picture circuit, and from that point the pictures are shipped to all of the picture houses on that "beat." When these houses have all shown them, the films are sent to the next circuit, and so on. These theatre men are permitted to run these pictures free of charge, and it goes without saying that they are more than glad to get them. They make great "special attraction" material. The pictures go from circuit to circuit until they are worn out. It might be stated that a picture that was started out about a year ago is still in good enough condition to "show."

The outfit required for this picture work is not prohibitive in price. The camera and complete finishing out cost in the neighborhood of $325. Redlands pays about $150 for the average reel of film of 1,000 feet. This figure represents only the actual cost of materials, however, for a local photographer does the work and in payment for his time and labor he is permitted the use of the picture camera during such times as it is not being used in municipal work. According to estimates received by this motion picture department it would cost between $500 and $600 to take and finish an average reel of this advertising film.

The Vitagraph, Lubin, Essanay and Selig studios will be described in forthcoming issues of THE WORLD'S ADVANCE.

MOVING PICTURES HELPING EDUCATION

A recent canvass made by a New York newspaper of thousands of schools and colleges throughout the United States discloses that these institutions are unanimously in favor of using films for educational purposes. And this is not surprising, in view of the fact that any one familiar with the problem of education has noticed that the eye is able to grasp facts with greater speed and precision than the ear. Furthermore, the impression received by means of the eye is found to be of longer duration.

It is rather unfortunate that scientific films have not found greater use in American schools. A large number of educational films on many different subjects have existed for a long time and are available for the use of schools, among these being reels on geography, history, science and natural history.

NEW WIRELESS TELEPHONE IN THE "MOVIES"

Aside from being a very interesting serial film, the "Exploits of Elaine" deserves no little credit for introducing many scientific inventions in a startling, yet instructive, manner. There is hardly a single new device that has not made

its appearance in the reels of this Pathé serial. A striking example is presented in a recent episode in which a wireless telephone system of new design is employed by Craig Kennedy, the detective, who is the hero of the story.

REELING the DRAMA in JERSEY

By GEORGE F. WORTS

NEW JERSEY, along the Palisades of the Hudson, is the birthplace and the home of the independent movie, where the first successful efforts to combat "the trust" were made. A half dozen companies produce there continuously. Others come and go over night. A visitor can hardly walk through the streets of this settlement without running the risk of becoming an involuntary movie actor.

"THE CHAMPION idea first saw light when the moving picture trust put me out of business. I had a theatre in Philadelphia, with a strong competitor next door—a larger theatre, which the trust, for some reason or other, seemed to favor more than mine. They showed newer and better pictures—because I couldn't get any others. So I closed up shop, made up my mind to produce pictures myself, and give the independent exhibitor a chance. After several unsuccessful attempts—for the trust was very strong—I finally opened the Champion Studios here in Coytesville. That was seven years ago. Now——"

The speaker, M. M. Dittenfass, manager of the "Champion," leaned from his seat in the automobile, and pointed beyond a clump of trees near the road to

the spidery framework of a huge steel building that could just be seen in the distance.

"That will be the new factory of the Universal," he continued, "the finest moving picture plant in the world. Jersey—along the Palisades—is the home of independent movies, you know. Half a dozen other companies besides ourselves have sprung up—are doing a big business here now."

He smiled. "I'll wager that per square mile, more drama is made and put up in tin cans in this locality than any other place in the world! Down the road a little way is the Solax—just around the bend are the Peerless and Hillit Studios. Others come and go over night. You can't walk through one of the streets in this neighborhood without running the risk of becoming an involuntary moving picture actor!"

A Question of Sunlight

We had drawn up before a long, low yellow building, before which a small wooden sign was swinging to the breeze. It read, simply: "Champion Studios." In the back, a glass-covered structure, rearing to a height of thirty or forty feet, glittered in the warm spring sun like a huge floral conservatory. To all appearances the Champion was a faithful replica of the studios on the Pacific Coast; and, as a matter of fact, the conditions for photography along the New Jersey palisades closely resemble those which exist at Los Angeles.

Actinic conditions, for picture making, so they boast in the West, are the finest in the world. Yet the Jersey producers claim identically the same thing.

"New Jersey sunlight," so one director told me, "cannot be equaled in any part of the world. Italian skies may be blue, but Jersey skies are bluer! We are several hundred feet above the Hudson River, and the air is remarkably clear. Just look at that sky!"

It was a pure, robins-egg crystal-blue, and the sun was dazzling. California and New Jersey, three thousand miles apart by bird line, are indeed remarkably alike in blueness of sky and brightness of sun. Possibly the nearness of the ocean has some influence in both cases.

Under the crystal roof of the Champion, a rural sheriff's office was being erected. Harry Meyers, who follows a double life there as director-in-chief and leading man, was reading a letter aloud in tones unmistakably vehement. This was not a part of the filmed drama at all. He was angry in earnest.

"Just listen to this!" he shouted, waving the letter in the direction of the other members of the company. "You cannot grasp a girl's ankle with a leer—and you cannot spit tobacco juice!"

The letter, we could plainly see, was typed on the official stationery of the National Board of Censorship.

He turned to his leading lady, Miss Thelby. "Rose," he demanded, "did you ever see me grasp a girl's ankle with a leer, or spit tobacco juice in a picture?"

"Of course not, Harry," she laughed.

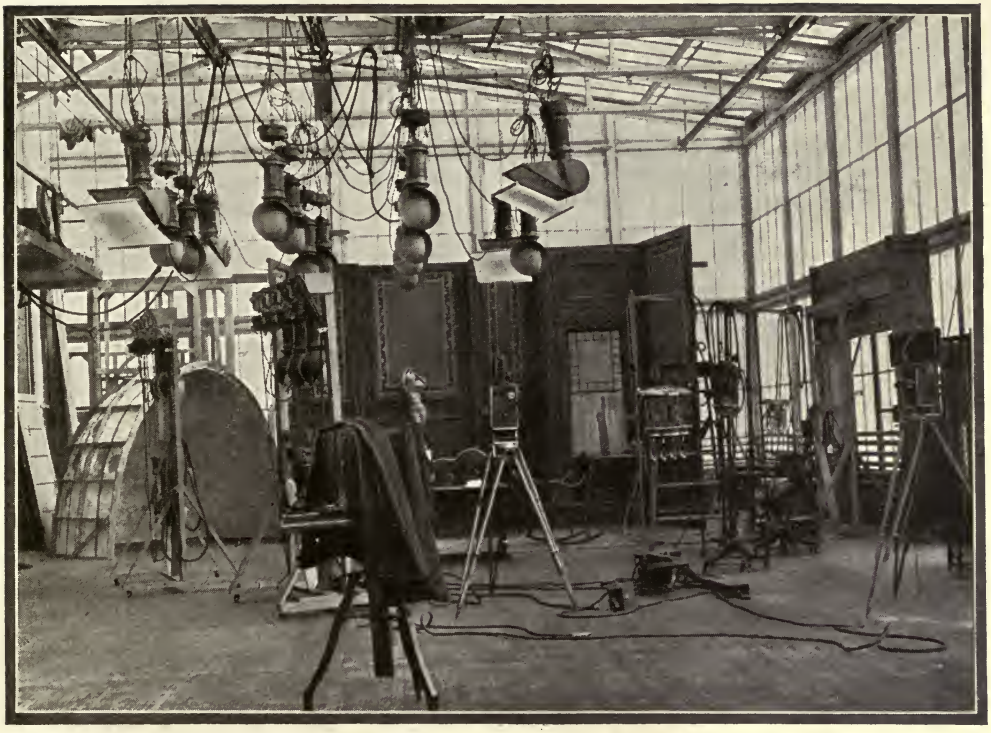
"It makes me tired," he grumbled. "Just because certain so-called actors pull off that rough stuff, we innocents get insulting letters like this!"

Harry Myers is a typical westerner in appearance, although not in reality. He is large and powerful of build, and he smokes Turkish cigarettes incessantly. He was attired, that day, rather curiously—half western, half rural. The net result was largely a problem in the mind of the beholder. A bright red skull cap was perched recklessly on one side of his head. The rest of the costume was made up of a light shirt, open at the throat, riding trousers, cloth puttees and heavy yellow boots.

When I questioned him, he laughed. "Why, I'm a simple little farmer boy, and Rose, over there, fresh from the bright lights of Broadway, is a simple little farmer girl."

In their startling make-up and odd-looking costumes they resembled anything but the parts they were creating. But when I saw the picture in a theatre some time later, the miracle which transpires in the lens—of transforming artificiality and inconsistency into the truest realism—became a little more apparent.

The story is told of a famous actor of the stage who once performed before a camera. The first time he saw the fin-



At the Time the Writer Visited the Solax Studios the Players were Indulging in a Brief Rest Between Reels. The Arc Lights were Extinguished and the Cameras and Stages were Deserted.

ished picture was in company with several friends at a theatre. As the film progressed, an expression of complete disgust settled on his face. Finally, he turned to the man nearest him. "Honestly," he whispered, "if my acting's as bad as that I'm going to move back to the farm."

Nothing but Mistakes!

The majority of movie folk who "see themselves as others see them" do not, of course, view their efforts in quite so bitter a light. But they do see their mistakes more glaringly than the most critical of audiences.

In a miniature replica of a moving picture theatre at the Champion—a projecting room, as it is called—the players are given a free opportunity for self-criticism.

"I call it 'The Chamber of Horrors,'" remarked the leading lady. "No matter how satisfied I am with my part when I'm playing it, a visit to this little room afterwards takes away all the joy!"

We were following a picture in which Miss Thelby played an important part. She was watching the screen intently.

"How do you enjoy yourself?" some one asked her.

"Nothing but mistakes!" she laughed. "I've counted twenty poses so far that should have been different."

The Passing of the "Friendly Studio"

The Champion is one of the few remaining links between the "friendly studios" of a decade ago and the growing factory type of to-day. Its atmosphere is warm and personal. For that reason, if none other, Champion films are bound to have a warmth of personality which one finds lacking to a sad extent in the majority of "factory brands."

Members of the charmed circle at the

Above: The Solax Finishing Plant, Which Is One of the Most Compact and Efficient in this Country. At the Right: A Daylight Studio Which Might Well Be Taken for a Huge Flower Conservatory When Viewed at a Distance.

Champion know each other by first name only—with the exception of Mr. Dittenfass, who demands respect not only as the visible tie that binds the Champion to the Universal system, but as the paternal head of the Champion family.

They were staging a rural scene on the road leading towards the Solax studio when I last saw them. Harry, in his bright red skull cap, was giving Charlie, the placid cameraman, instructions, while Rose, the leading lady, from her perch on a fence rail, was laughingly advising several wide-eyed Coytesville school girls just how to become movie actresses.

Siberia à la Jersey

The Solax studios were indulging in a brief rest between the reels of a lengthy film-version of Service's poem, "Dangerous Dan McGrew." The huge crystal-roofed studio was nearly empty. A bank of flaming arcs, unlighted, stood in one corner with a camera on its brawny tripod, while, at the other end of the room, two property men were at work, one on an eskimo igloo, the other stuffing a dummy to be used in a death leap scene.

The Solax Company specializes during the winter months on Alaskan and Siberian pictures. To these, the rigors of the Jersey winters and the ruggedness of the Jersey landscape lend a surprising amount of assistance. An escape from Siberia, which we saw in the projecting room, was realistic enough to satisfy the most doubting of audiences.

A Stage that Follows the Sun

Probably the most ingenious feature of the Solax plant is an outdoor revolving stage. The platform is pivoted in the center to a block sunk in the ground. It revolves on wheels on a circular steel track. By the use of this stage for a long act, the sun, as it moves in its path across the horizon, can be followed, and the usual undesirable shadows are thus avoided.

Near the revolving stage was a large wood box which appeared to have been at one time a swimming tank in miniature. A smaller box was connected to it by a large pipe, and elevated a few feet above the ground. These tanks, so the director explained, were recently the "props" for a prison picture in which a

convict escaped through a sewer. The large tank was painted to resemble a prison cell and the smaller one filled with water.

The actor-convict broke the thickness of stone which covered the opening of the pipe, and escaped by holding his breath and crawling through the rushing water into the upper tank. The feat was daring, unquestionably, but not nearly so thrilling as the finished picture, which, of course, did not disclose the trick.

A Talk with a Pioneer

Just across a narrow driveway from the executive office and studio of the Solax is situated a low brick building where the films are developed and printed. It is one of the most compact finishing plants in this country. Thousands of feet of film are turned out daily, an amount which represents not only the product of the Solax, but the output of other companies in the vicinity. A small projecting room, where the positives are examined by censors, is in one corner of the building; developing, printing, drying and finishing rooms fill up the remainder of the floor space.

The films are developed on wooden racks in deep metal tanks, and dried in an adjoining room on immense web-like reels, which are revolved slowly by electric motors.

The Technical Director, Mr. F. Doublier, who is the guiding genius in the handling of the films, was one of the first men to ever operate a moving picture camera. He was a pioneer with the Lumieres of France, and he has a fund of interesting and amusing anecdotes of the early days of the motion picture.

"I took one of the first moving picture cameras," he remarked, "on a trip through Europe and the Orient. Of course, we had no such elaborate printing and developing machines as these. I developed films in pails on the floor of my bedroom and printed by the light of a kerosene lamp. I travelled through Siberia—China—Turkey, and when I returned, I showed the pictures in many cities of Russia and the Netherlands. In Moscow and Amsterdam, especially, the

At the Left: A Stage That Follows the Sun—the Platform Revolves on a Circular Track. Below: Behind the Scenes at the Peerless Studios. Here Are Scene Painters at Work on Backgrounds for Coming Productions.

films were very much in demand."

"Were the audiences afraid at first?" I inquired.

"Afraid! I should say they were! I recall one film that stampeded nearly every house. It was a picture showing the Nord Express flying into the station at St. Petersburg. I took the picture with the train coming head on at full speed. When the audiences would see that train rushing down the screen directly for them, they would shriek, and run pell-mell out of the theatre. I had to stop showing it finally; it spoiled my business!

"It has been interesting," continued Mr. Doublier, "to watch the wonderful growth of the moving picture industry and particularly the improvements in moving picture machinery. Just look at these machines—" He indicated, with no little pride, a clattering group of automatic printers. "They turn out miles of film a week. We often call a day's work from seven in the morning until two the next morning. It's a little different from the good old days with Lumiere!"

A Star Who Did Not Shine

A brisk, fifteen minute walk through a farm yard and along an interurban car track separates the Solax plant from a group of new buildings, whose shimmering crystal roofs and walls mark them, even from a distance, as movie studios. Down the street which leads to these studios—the Hillits and the Peerless—a girl, whose poise and trimness stamped her, certainly in these parts, as a movie actress, was walking rapidly. Our meeting was a coincidence. Just as I was about to pass her, a sharp explosion sounded in the road beside us—a street gang was blasting a ditch for a pipe line. She turned a pair of startled, well-trained eyes upon me and gasped: "Is there any danger?"

The foreman of the gang shouted, just then, that the blasting was over, and that we could proceed. I asked my companion if she were with the Peerless.

"No—not yet," she replied. "I have been with the Solax—I've just put on 'Dan McGrew.'"

"Did you by any chance play the part of Lou—the heroine of the poem—the lead, of course?"

"Oh, yes, that was my part."

We passed the first of the two Hillit Studios, which was being refinished for rental. The manager of the "World Comedies" Company, which occupied the second building, was conversing with one of his directors when we came up. He nodded brusquely to the girl.

"Anything open to-day?" she asked.

"Nothing doing," he replied coldly. "Better try the Peerless." The girl left abruptly.

The manager jerked his thumb towards her. "Some of these third rate ingenues who try to put across the Mary Pickford impressions make me tired," he grumbled.

"I thought she was playing a lead with the Solax," I put in, surprised.

"Her?" he exclaimed in disgusted tones. "Why, she's nothing but a filler. We let her play some unimportant society stuff once in a while. Movie actresses as a rule are the most imaginative and the most unreliable—"

"You're wrong," interrupted his companion, laughing. "One of your most dependable actors threw up his job this afternoon when we were in the midst of an important road scene—spoiled the day!"

"Who did that?" demanded the manager.

"The dog! He absolutely refused to work—ran away with six understudies that were trailing us!"

Trying Out a New Face

A few minutes later, while the manager was eating a hasty afternoon lunch consisting of a ham sandwich and a pail of coffee, having seated himself on an upturned box in one corner of the littered studio, the director, whom, I had learned, was Thomas Jefferson, son of the famous actor, was testing an applicant's ability of facial expression.

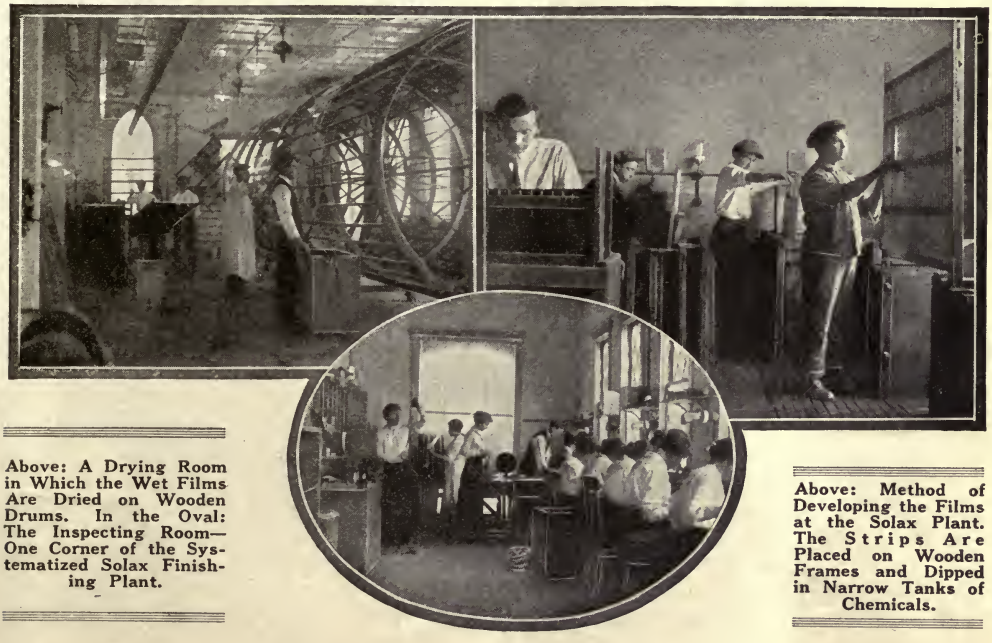
She was a pretty girl, with a great deal of confidence; but she was totally unprepared for Mr. Jefferson's rather startling trying-out methods.

"Sit down before the camera," he requested her, "and when I talk to you, make your facial expressions conform instantly to the character of my conversation."

He adjusted an arc lamp, so that its rays concentrated on her face. The camera man began turning the crank.

"Oh, Miss Jackson," exclaimed the director, his voice brimming with stage-pathos, "just think of a poor old man—with white hair flowing—walking across the path of an approaching street car! See that car! Good heavens! It's bearing down upon him—it's going to hit him!—is he being ground by those merciless wheels!—Ah! The car has stopped! What's that? Ha Ha. Why, Miss Jackson, the old man has jumped up and he's beating the motorman over the head with an umbrella! Stop, camera!"

"Do you realize what facial stunts Jefferson made that girl perform—in that short trial?" the manager was saying between gulps of coffee. "Something like this: comprehension—sympathy—excitement — fear — indignation — horror — remorse — relief — amusement — and various shades in between. The more numerous and the more distinct the facial expressions, the greater are the actor's or actress's chances for becoming famous. The shape and size of the face are important, too. On the screen, a thin face looks drawn and haggard; a fat one, balloon-like. The girl that Jefferson has been trying out is a favorable prospect. The film, however, may prove that she is useless for our purpose. We will develop it in our darkrooms to-night, look it over and give her our decision to-morrow morning. We try to do everything on the same short-cut yet effective scale as that. Our production consists of nothing but comedies—and we have revolutionized the "Broadway Stars" idea in films—by showing stage favorites in single reels. Many producers have the mistaken notion that you can't put a Broadway star on the screen and make money unless you show several miles of him. Our pictures—and our pocketbooks—prove just how foolish that idea is!"



Above: A Drying Room in Which the Wet Films Are Dried on Wooden Drums. In the Oval: The Inspecting Room—One Corner of the Systematized Solax Finishing Plant.

Above: Method of Developing the Films at the Solax Plant. The Strips Are Placed on Wooden Frames and Dipped in Narrow Tanks of Chemicals.

Watchful Waiting

Around the corner from the Hillit Studios looms the gigantic concrete-and-glass home of the Peerless. This is one of the distinctly factory types of studio, with a time clock, an appreciable office

force and a waiting-room-full of actors and actresses. Here I again saw the "leading lady" from the Solax studios. She was sitting haughtily aloof from the others. In fact, the majority of these position seekers seemed to have affected a haughty and a rather bored attitude. However, when a director would enter the room, their expressions would promptly become galvanized into eager animation. They represented a variety of types, and they are known by their particular type much more commonly than by their names—sober-faced English butlers—young and pretty school girls—pathetic looking "Grandmothers"—stolid Irishmen—apathetic Italians—and even an occasional ruffian.

The path of a moving picture player is not an easy one to travel. The supply greatly exceeds the demand. Unless a player is well-known, his lot is that of the crowded waiting room.

The New Idealism of the Movies

It was nearly closing time and my trip through the studio was a flying one. The Peerless is done throughout on the factory plan. The studio is enormous—a spacious, glass-covered affair, with ten thousand square feet of floor area, providing ample room for the production of a half-dozen plays simultaneously. "The Pit," "Trilby," "Love in the Moonlight," "The Boss," and "An Indian Idol"—all featuring well-known stage players—were being photographed that afternoon. The result was a scene of feverish activity. Directors at temperamental white-heat were urging on their little bands of actors, to conclude their particular sets before the fast reddening sunlight should die away entirely. In the darker corners, stacks of vapor lamps were shedding their ghostly light already.

"We are compelled to work at top speed every minute," remarked my guide. "Weeks are required to finish a long play—and it is essential that the pictures reach the public before the plays become stale."

The pay-roll of the Peerless aggregates thousands of dollars weekly, chiefly because of the costly services of the principals.

The Peerless ideal is shaping towards a higher dramatic standard of filmed plays. D. W. Griffith, probably the highest authority in the motion picture business to-day, predicted recently that five dollar photoplay productions will come as a matter of course—the result of public demand and the sincere efforts of the producers to meet it. That is one reason why the theatre with the screen is rapidly gaining ascendancy over the theatre with the stage.

The policies of the directors at Movieville are widely varied; yet they all point towards a higher dramatic standard of picture plays in general. Big things can be expected from the glistening crystal buildings along the Jersey Palisades, because big things have been done in the past. A tremendous initiative took root there seven years ago—and it has borne fruit in an astonishing fashion ever since.

MOVING PICTURE ACTING NOT ALWAYS FUN

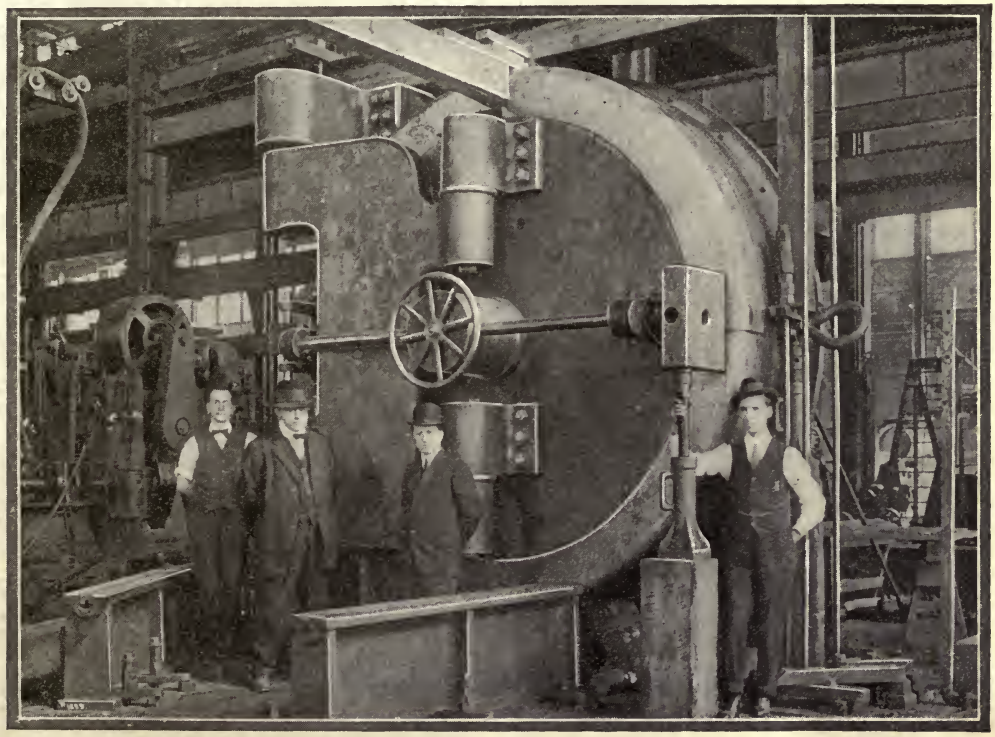
Missing death by a hair in a desperate race with a thundering express train, as well as dropping nearly one hundred feet from a racing motor car over a cliff into a raging torrent, are two of the remarkable feats that have had to be undertaken by actors in the production of the serial picture "The Diamond from the Sky," now being produced by the Flying "A" studio. In the matter of the automobile being driven right across the track and in front of a fast approaching train, the main feature in staging this picture was accuracy. The speed of the train as well as the automobile had to be carefully timed. In the latter picture, however, it required sheer pluck on the part of the actor. While the machine was dropping over the cliff the actor disengaged himself from his seat and leaped out of the machine. He alighted with a splash in the water some distance away from the automobile.

A MODERN BANK VAULT DOOR

The largest circular vault door and vestibule ever constructed were recently built at South Bethlehem, Pa. The enormous size of the safe may readily be imagined from the illustration in which several men of average size have posed to facilitate comparison by the aid of the eye.

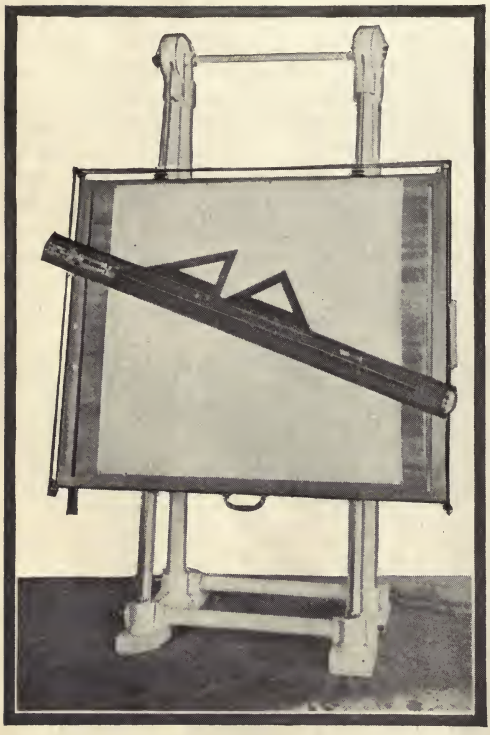
In figures the vestibule is 10 feet 8 inches in diameter, the size of the door is 8 feet 8 inches outside diameter and 7 feet 8 inches inside diameter, or clear entrance through the vestibule. The door is 45½ inches thick and is controlled by twenty solid steel locking bolts 5 inches in diameter, which are in turn controlled by the latest design timelock having four separate movements. The operation of any of these movements releases the mechanism, which in turn is again checked by two of the largest and most up-to-date combination locks, the proper adjusting of which will permit the door to be swung open.

The door swings on a seven-ton cast steel crane-hinge and is so well balanced and adjusted that it can easily be swung open by hand. In closing the door it is forced to a watertight seat by means of heavy pressure mechanism, thus preventing the introduction of any liquid explosive. The main vestibule weighs 51,000 pounds, while the main door with the bolts and mechanism weighs 80,000 pounds. The emergency vestibule alone weighs 40,000 pounds. The resistance one would encounter by trying to drill the metal may be estimated at about 2,880,000 pounds per linear foot.



The Largest Circular Vault Door and Vestibule Ever Constructed, on the Floor of the Factory, Ready for Shipment. So Wonderfully Balanced is the Huge Door that it May be Swung Open by Hand.

If you enjoy THE WORLD'S ADVANCE, tell others; if not, tell us. Have you any suggestions to offer? The magazine is edited to please its readers and meet their requirements. Accordingly, suggestions are welcome at all times.



Although a Radical Departure from the Usual Practice, the Vertical Drafting Board has Many Distinct Advantages.

A VERTICAL DRAFTING BOARD

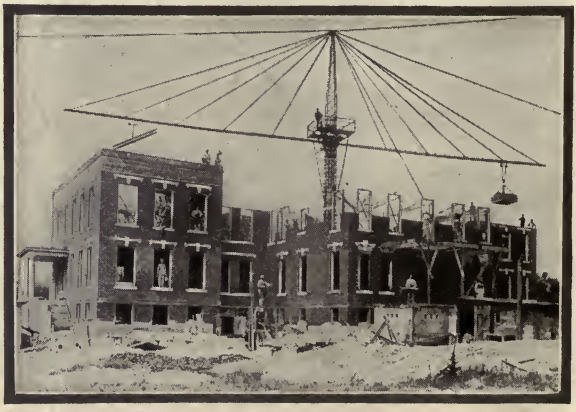
Vertical drafting boards have several distinct advantages over the horizontal type, and they are being adopted to an increasing extent in the most up-to-date drafting rooms. A new vertical board has been devised which permits a draftsman to work either sitting or standing. From any position he can bring any section of the drawing before his eyes. The board is fixed at an angle which has been determined by scientists and engineers who have been using the vertical board for years. The drawing implements are placed on a small shelf which moves with the parallel rule, many unnecessary movements being thus saved. An advantage of this arrangement is that the tools are not in the way and that, quite contrary to the usual custom, the drawing is visible and not littered with tools, papers and dirt.

It will be seen that the rule can be set at an angle and moved up and down parallel to whatever position it was set in originally. The balancing mechanism is concealed and moves noiselessly. The frame is of enameled metal and can be dissembled easily.

A REVOLVING CRANE MAST

In an endeavor to employ the most economical method to handle the stone and concrete work as well as the bricks, a middle west contractor designed and used a revolving mast crane with a cantilever boom in building a school. So successful has this device been in the construction of this building that a patent has been applied for covering the use of this style of crane in constructional work.

As will be seen in the accompanying illustration, the school under construction extended over quite an area. However, by the use of the revolving mast crane with cantilever boom, it was found possible to place cut stone at any desired spot and at about one-third of the estimated cost. In placing the cut stone the first operation was to lift it high enough to clear the walls, revolve the crane to the proper position and then run in the trolley over the spot desired. The motive power was supplied by a five horsepower motor at the base of the mast.



A School Building Being Erected with the Aid of a Revolving Crane Mast. Much Time and Labor are Saved by the Use of this Equipment.

Extremely delicate controls permitted the work to be carried on with the greatest speed and accuracy.

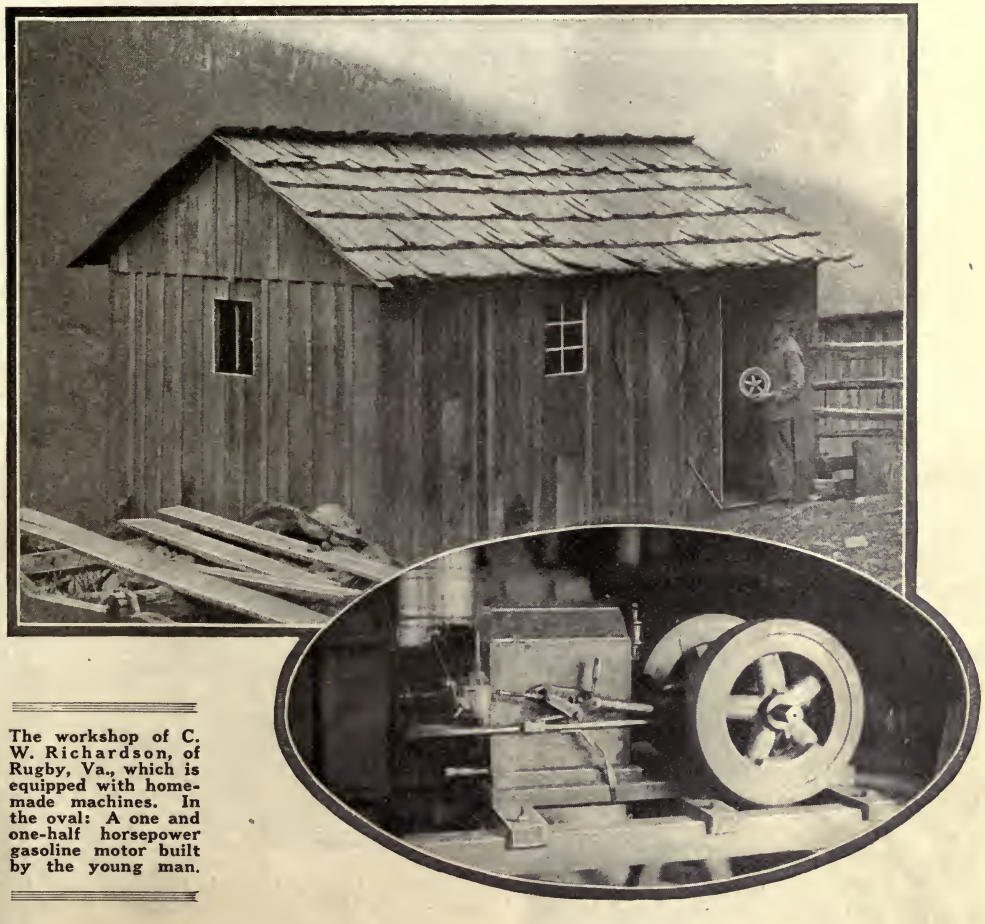
A MARINE HARVESTER

Not long ago there was placed in use at San Diego, Cal., the first sea-mowing machine for the purpose of cutting the millions of tons of kelp and seaweed that grow along the coast. A gasoline-launch was fitted with a horizontal jack-shaft revolving at right angles to the keel. Two vertical shafts were fitted with four-foot blades that revolved at high speed ten feet below the surface.

The mowed kelp floats ashore, is taken out and dried, and later is hauled to a factory to be converted into fertilizer.

BUILDING MACHINERY FROM BOOK AND MAGAZINE INSTRUCTION

Considerable credit is due C. W. Richardson of Rugby, Va., for the ingenuity he has displayed in building his own workshop and equipping it with a modern set of hand tools and machinery. While this young man has not had the advantages of a technical education, he has acquired a vast amount of knowledge from books and magazines, which has enabled him to construct his shop and its equipment. At the beginning he had at his disposal a few hand tools, a small foot-driven engine lathe and a buzz saw. That he made the utmost use of this crude equipment is proven by the fact that he has already built a practical 1½,



The workshop of C. W. Richardson, of Rugby, Va., which is equipped with home-made machines. In the oval: A one and one-half horsepower gasoline motor built by the young man.

horsepower gasoline motor which he now uses to drive his machinery. Aside from the engine, he has constructed two phonographs, numerous telephones and several other instruments. His work has also resulted in the invention of a governor on which he has secured a patent.

THE STUDY OF GEOGRAPHY MADE INTERESTING

In order to make the study of geography a more interesting subject to the youngsters, a teacher of Southern California has designed and built a clever electrical map which he has found very successful in use.

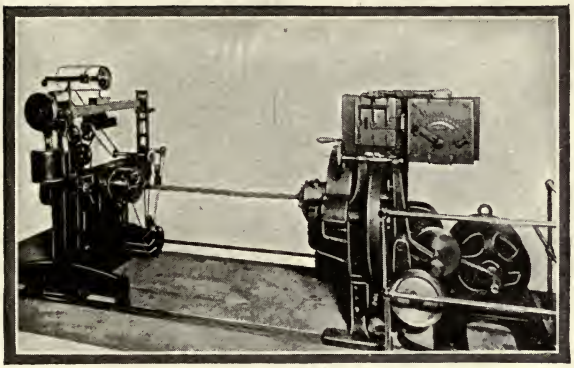
The particular subject in which this teacher is interested is Palestine, as will be seen from the illustration. However, the idea can be extended to a map of any other part of the globe. The location of the various cities, rivers and mountains is designated on the map by brass-headed tacks which are connected by wires to a switchboard bearing the geographical names. An indicator of suitable form and having an electric bulb attached to its extremity is also connected in the circuit. The bulb is enclosed in a wire cage which serves the double purpose of protecting the bulb and as a means of making contact to complete the circuit.

By the Novel Application of Electricity, the Teaching of Geography is Made Attractive to the Pupils.

When the map is to be used, one boy acts as switch tender. The teacher asks another boy to locate one of the cities or spots figuring on the map. Meanwhile, the boy to whom the duty of switch tender has been assigned introduces a plug into the switchboard at a point which is labelled with the name called out by the teacher. The answer is given by the boy not in words, but by placing the extremity of the indicator at the right point in order that the cage containing the electric bulb will come in contact with the tack identifying the city or other point to be found. If the pupil is correct the contact will be established and the bulb will illuminate the spot. Should he fail to select the right location the bulb will not light.

There is nothing complicated in the construction of the electrical map, and one may readily be made by any person possessing a working knowledge of electricity. If desired, the electric light may be replaced by a buzzer or bell, or, if the most striking result is sought, both the light and a buzzer or bell may be employed together. The suggestion this map offers may be applied to other subjects in which charts are employed, with equal success.

It is announced that electric-pneumatic brakes are to be used on the passenger trains of the Pennsylvania Railroad.



A Machine for Testing Strength of Steel, which has a Capacity of 230,000 Inch Pounds.

TORSION-TESTING MACHINE

One of the interesting exhibits at the San Francisco Exposition is a machine for testing the twisting strength of steel, which records autographically the torsion curve of the piece of metal under test. Heretofore this measurement has been calculated, with more or less accuracy, by the person making the test. It has a capacity of 230,000 inch pounds and will test specimens ranging from one-eighth of an inch to two and a half inches in diameter, and of any length up to eight feet.

ELECTRICITY EVERYWHERE

A house that is being exhibited at the Panama-Pacific Exposition is equipped with labor-saving devices throughout, all of which are driven by electricity. The kitchen is equipped with electrical devices of all kinds, a potato peeler and refrigerator. The dining room is arranged to show how light lunches can be prepared with electric chafing dishes and stoves. At the rear of the house is an electric workshop and garage ready for recharging batteries.

THE TREE SUMMER SEAT

The fact that summer rest seats do not have to be expensive to be attractive is demonstrated in the seat seen in the accompanying illustration. The seat has been termed the "Tree Summer Seat," from the fact that it is really built around a tree which was at one time growing at the point where it now stands. Upon finding that the tree had lost all signs of life, the gardener in this park devised the novel idea of turning the dead trunk into this artistic seat, rather than dig it out bodily.

Suiting the action to the decision he cut the main limbs off about six feet from the ground and to the top of these fastened a pretty roof, which is made of palm branches. This done, the seat, which runs all around the trunk at a distance of about a foot and a half from the ground, was made out of sections of palm branches. In addition to being inexpensive, this seat is one of the most attractive in this very elaborate park.

This suggestion might well be followed by others. It is not an uncommon sight to see unsightly dead trees in public parks, which might be converted into useful and ornamental objects instead.

An Attractive Summer Seat and Shade Built About the Trunk of a Dead Tree.

The Lifting Power of this Deck Girder Bridge is Furnished by a Gasoline Engine.

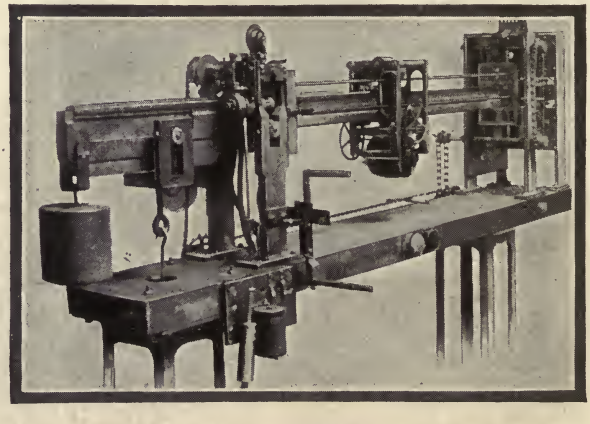
GASOLINE ENGINE OPERATES DECK GIRDER BRIDGE

There has recently been constructed for the Canadian Northern Railway at Kamloops, British Columbia, a deck girder bridge 1,209 feet long and a deck girder lift span 93 feet long. There are 12 fixed spans also of 93 feet length. Approaches at both ends of the bridge total about 1,100 feet. The lift span weighs 118 tons and is fully counter-weighted. The sixteen 1¼-inch lifting cables are equalized in the attachment to the span. Centering castings provide for keeping the span in proper alignment as it comes down to bearing and also take the longitudinal braking thrust. The lift of the span is 53 feet, giving a 55-foot clearance above high water. The motor is capable of raising the span in 100 seconds. The lifting power is a gasoline engine, which, with all the machinery except the operators' levers, is located below the deck, at the middle. Limit switches coming into operation near the ends of travel of the span control the igniter circuit of the engine.

A SCALE IN WHICH ELECTRICITY DOES ALL THE WORK

A scale engineer of Columbus, Ohio, has recently demonstrated the first working model of an automatic weighing and recording scale. It is stated that his invention bids fair to revolutionize the manner of weighing coal, iron, lead, zinc, copper and other mined products. His scale can work as high as twenty loads per minute, and have each weighing operation accurate to within an ounce on each 100 pounds, while printing at the same time a ticket showing each weight and also recording on a tape the consecutive number of each load and its weight. The scale is operated by electricity and thus eliminates all chance of mistakes common to human operatives.

The scale is said to be not only entirely automatic in operation, but also fool and cheat proof. It is believed that the use of this type of scale in the Colorado coal mines will go a long ways toward settling misunderstandings between miners and mine owners, now so commonplace.



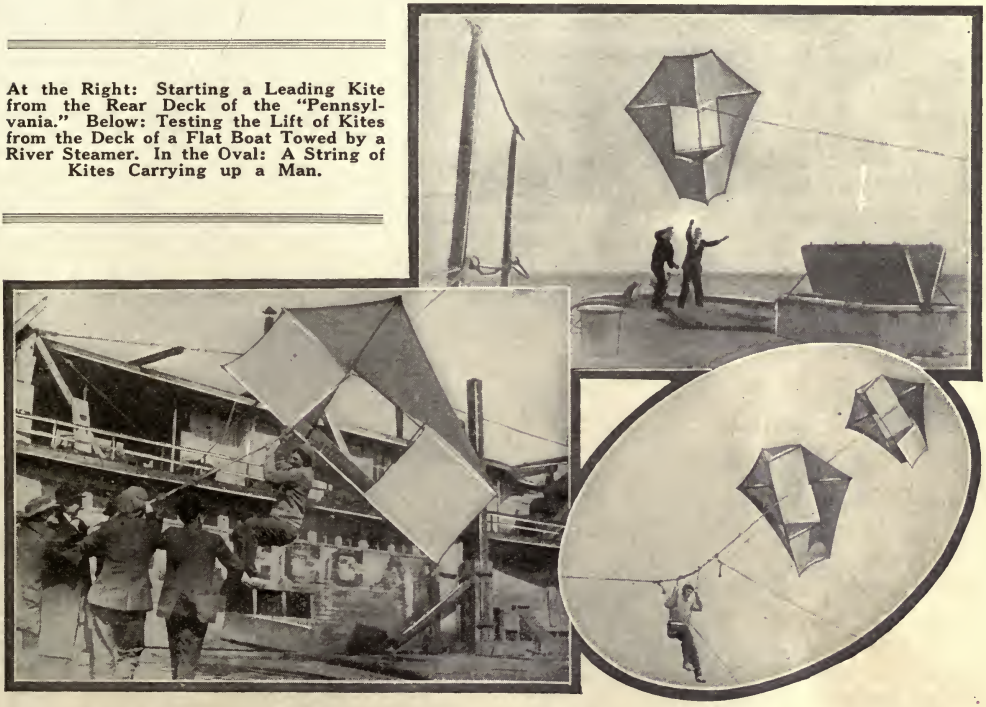
A Scale in which Electricity Does all the Work, Both Automatically Weighing Truck Loads and Keeping a Permanent Record.

Combating Submarines with Kites

By Stanley Yale Beach

THE sinking of the *Lusitania* has caused many inventors to suggest new means for protecting ships from attacks by submarines. Among the best suggestions is that of Mr. Samuel F. Perkins of Boston, Mass., who proposes to use kites to detect the approach of submarines.

The following experiments carried out by Perkins show that he was able to obtain practical results without meeting with any serious accident: At the Harvard-Boston Aero Meet, held in September, 1910, he sent up a number of men to a height of about 200 feet by means of a string of from six to fifteen of his huge 18-foot aeroplane kites. At Forest Park, St. Louis, on Thanksgiving Day, 1910, he was raised to a height of 350 feet by his kites, breaking all previous records; and at Los Angeles, on Christmas day, he ascended to 400 feet, and for the first time sent wireless messages. At San Francisco Aviation Meet, in January, 1911, Perkins demonstrated his man-lifting kites for army purposes, and in a duration test he remained aloft for 1½ hours at a considerable elevation. Finally, in September, 1911, at the Nassau Boulevard Aviation Meet, over 350 people were taken aloft by fifteen kites in a single afternoon, including all the aviators who participated in the flying events of that meet.



At the Right: Starting a Leading Kite from the Rear Deck of the "Pennsylvania." Below: Testing the Lift of Kites from the Deck of a Flat Boat Towed by a River Steamer. In the Oval: A String of Kites Carrying up a Man.

In sending up his kites Perkins generally sends two or three leader kites up about a half mile in order to get them in the steady wind. Then he sends up a group of six, eight or ten lifting kites, directly beneath which, on the main line, is suspended a sort of bo'sun chair or swinging cradle. If there is a heavy wind this cradle sometimes swings violently and the occupant has to be careful not to be thrown out. In light winds an ordinary hexagon kite is used, but in heavy winds a special kite called an aeroplane kite—which has a square hole in its

center for the circulation of air and a triangular body beneath—is used. In two of the illustrations Perkins is shown above the Allegheny River at Pittsburgh, and testing the lift from a float towed by a river steamer. In the latter instance five lifting kites were on the line above the one shown. The ropes in the view showing him aloft are guide ropes which help to steady the line when landing. The third illustration shows the first leading kite, which has a ten-foot side, being sent up from the stern of the battleship *Pennsylvania* when cleared for action. Some of the lifting kites are 18 feet long.

The experimenter's most important work was done on the *Pennsylvania* from January 24 to February 4, 1911, when he made a 500-mile cruise off the Californian coast at the request of Rear Admiral Pond, in order to demonstrate to the Navy what he could accomplish. He sent up in succession Lieutenants Rogers and Charlton to a height of over 400 feet when the cruiser was steaming 20 knots and going through war maneuvers. The men aloft were able to sight vessels 40 miles away. Submarines operating in the vicinity of the cruiser were easily detected, especially when the *Pennsylvania* was "on soundings," that is to say, in water 50 to 60 fathoms deep. When observers at the masthead were unable to see anything, the men carried up by the kites could distinctly observe the submarines at a distance of a mile or so from the ship. Even in the open sea, when traveling between San Francisco and Los Angeles, they could pick out the submarines with but little less difficulty.

The experiments mentioned prove that a merchant vessel which has a speed of 12 to 15 knots is able to carry a string of kites and send them aloft with a sailor in a bo'sun chair in order to secure ample protection against submarines. The kites are available at practically all times. Rain does not affect the kites, and when there is a gale that no aeroplane could live in they can be sent aloft quite readily, and then possess the added advantage of being able to carry two light observers instead of but one.

RUNNING A STREAM BENEATH A STREAM

An engineer in the western part of this country was up against the proposition some time ago of making a stream cross a stream, and in order that this might be done he built above the main stream a concrete bridge or trough through which stream No. 2 might pass. In a word the situation was like this: An irrigating canal twelve feet wide and four feet deep ran through a certain stretch of country. Running at right angles to this ditch are a number of natural storm drains. It was desired that the water from these storm drains should not empty into the main ditch and to avoid this these bridges were constructed. The water in the main ditch is used to irrigate valuable orchard land, while that from the various washes goes direct to a nearby river.

A Concrete Bridge that Serves to Carry One Stream Above Another.

The bridge shown in the accompanying illustration is fifteen feet in width and sixty feet long. Its walls are eight inches thick and forty-two inches in height. The sides and floors of this

A View of a Portion of the Celilo Canal in Oregon. This Waterway Is the Second Largest in America, and was Built at a Cost of Six Million Dollars.

bridge are of solid concrete, decoratively finished as may be seen in the illustration.

GREAT BRITAIN BUILDING BIG JAMAICA RADIO

Although no technical details are available, it is now known that Great Britain has under way a most powerful radio station to be installed in Jamaica, B. W. I.

THE CELILO CANAL

At a cost of six millions in money and the labor of hundreds of men continuously for almost ten years, Uncle Sam has at last completed the Celilo canal in Oregon on the Columbia River. The big ditch was formally opened May 5th by a celebration which actually began May 1st and did not conclude until May 8th. The celebration was a progressive affair, beginning at Lewiston, Idaho, 500 miles from the river's mouth and the present head of navigation on the Snake River, the Columbia's principal upper tributary, and continued on down river to Portland on the Willamette River, the principal stream emptying in the Columbia on its lower stretch. Those participating in the several programs traveled by steamboat in honor of the opening of the great waterway—the second largest in America—through the various locks and the entire length of the remarkable canal just then completed.

Celilo canal is one of the marvels of modern construction. It is eight miles long and the greatest part of it was bored through solid lava rock stone so hard that the construction cost averaged almost $1,000,000 per mile. At some points a sheer cut of 70 feet through live rock was necessary. All types of wall construction obtained, from the reinforced concrete to ordinary masonry and dry masonry.

At several points workmen found the charred trunks of trees buried deep in the lava where they had been overwhelmed centuries ago when the great stream of molten rock flowed across the

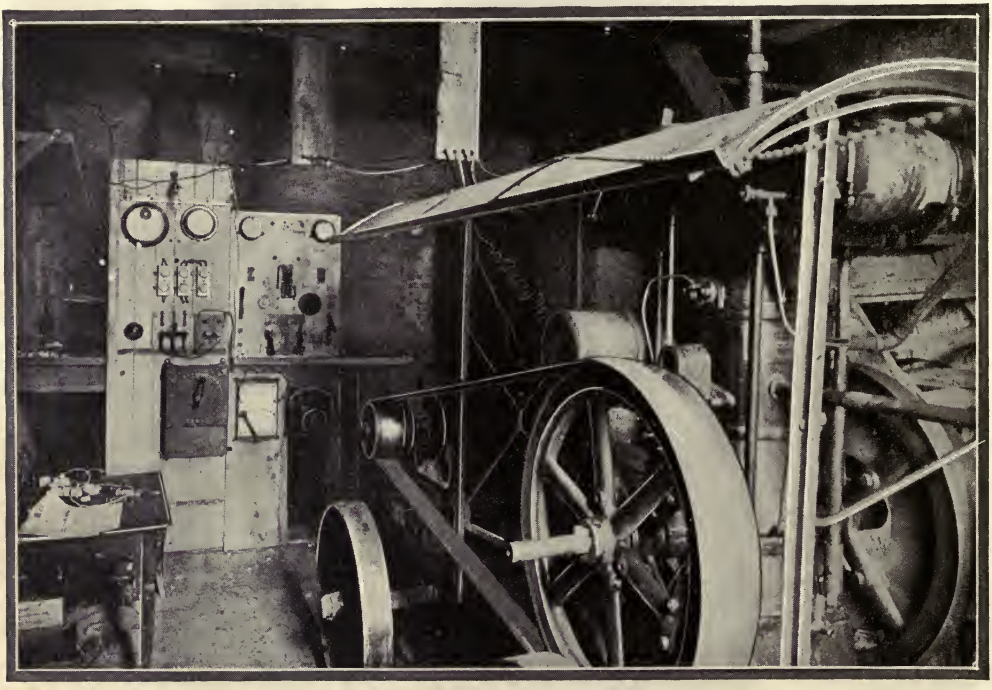
valley floor and dammed the river, creating the Celilo falls and rapids around which the locks are built.

Construction of the canal began in October, 1905. There are five locks, with ten passing basins for vessels, that overcome an 82-foot fall made by the river between the head and foot of the ditch. The minimum depth of water in the canal is eight feet.

Owing to the fact that the river annually experiences a heavy flood, spillways are built along the canal walls at regular spaces to relieve pressure from flooding, while the sixty-ton lock gates are each braced against concrete stands, 21 feet wide, to withstand the tremendous weight of water which they must bear against. The lock gates are operated by hydro-electric power.

IMPROVISED ELECTRICAL PLANTS FOR WAR

Power plants of the Benz type are in general use by the German Army in the field, for the immediate utilization of the captured French and Belgian plants.

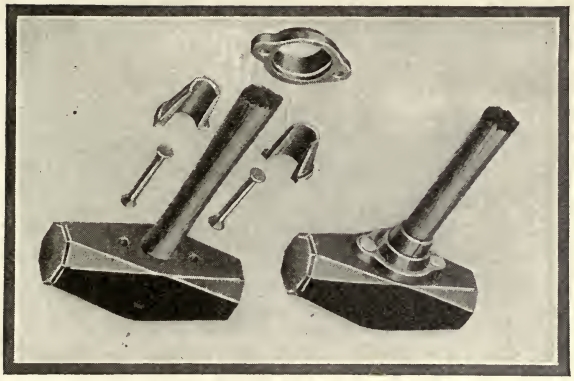


The German Army is Using this Type of Electric Generating Plant Mounted on Wheels and which can be Immediately Installed at Any Desired Point for Supplying Current for Illumination and Other Purposes.

The accompanying illustration shows a plant wherein a traction motor of the Benz system is furnishing the necessary current to a field hospital. As for every other military task, soldier specialists also operate the improvised plants.

SAFETY LOCK FOR SLEDGE HAMMERS

To minimize the possibility of injury to workmen when a sledge hammer is being used, a safety lock has been devised consisting of three steel castings. One is a circular flange cut with a hole slightly tapered into which two wedges fit. Two holes are drilled in the head of the sledge to conform to the holes in the flange. The wedges are then fitted to the handle close to the head of the sledge, the ring



A New Type of Sledge Hammer in which the Danger of a Loosened Head is Entirely Eliminated.

is slipped over the wedges and connected to the sledge by two rivets. When the lock is in place, it is impossible for the head of the sledge to fly off. The sledge may break into two pieces at the eye, but the lock will hold them together. As may be seen in the accompanying illustration which clearly shows the various parts as well as the complete hammer, the design is quite simple and ingenious.

PORTABLE ELECTRIC SHADE WASHER

The invention of a portable electric shade washer by William A. Richardson, chief electrician of the Chicago Post Office has solved the problem of cleaning the 14,000 lamps and shades used in this building. Formerly it required a man about six months to make the rounds, at the end of which time the first lamps had become very much soiled again. With the aid of the new device, however, all of the lamps can be cleaned once each month.

The lamp and shade washing machine, which has now been in use three or four years and is said to be the only one of its kind, consists of two galvanized iron tanks, the one appearing at the left in the illustration being the washer and the one at the right the rinser. The washer is equipped at the bottom with a propeller such as is used on a motor boat, which serves to throw the water against veins attached to the inner surface of the tank. These veins direct the flow of the water so as to throw it up through the shades and down over them again. The shades are placed sixty at a time in a wire basket, which is then lowered into the washer. The water is heated electrically by means of an electric immersion coil placed at the bottom of the tank. It requires from three to five minutes to clean one basketful of shades.

In the rinsing tank ammonia is added to the water, which serves to give a lustre to the shades. After rinsing they are left on a shelf in the second tank, where the water on most of the lamps drains off, saving the necessity of drying them with a cloth.

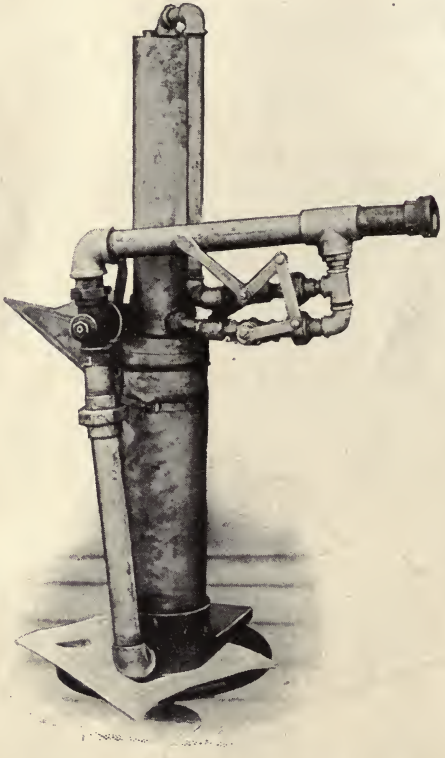
On the end of the motor a buffer can be placed to clean and polish any lamps. The buffer enables the glassware to be cleaned in much less time than would be possible by hand. This is especially the case when cleaning fancy pressed glass shades that have many ridges in which dirt accumulates and can only be dislodged by a very vigorous and lengthy application of a brush and soap.

A Complete Outfit for Cleaning and Polishing Electric Shades, which is Being Used in One of Chicago's Public Buildings.

COMPRESSED AIR BLOWS BALLAST UNDER TRACKS

A machine for injecting ballast under ties after the track has been lifted is the invention of a Canadian. His machine, which has been designed to work in conjunction with compressed air, will probably mean an economy in cost of labor amounting to an average of 75 per cent.

The operation of the compressed air ballast is quite simple. By means of a series of valves and pistons, the air is caused to act upon the ballast. The toe of the machine, which is placed underneath the end of the tie, is equipped with a gauge capable of adjusting the toe's aperture for admission of gravel of various sizes that is employed in lifts of from one-eighth of an inch to two inches.



By Means of This Device it is Possible to Inject Ballast Under Railroad Ties After the Track has been Lifted.

To illustrate the value of the new injector, it is claimed that one motor car equipped with compressed air pumps will operate eight of the machines at a time with a capacity of four miles a day and a maximum cost of about $100 per mile. On the other hand, the cost of maintaining roads in the usual way is about $250 a mile, the basis for this cost being the fact that one laborer averages 56 feet of track a day.

The machine stands three and a half feet high, and is generally made of steel material. It weighs 47 pounds. It is also made in aluminum, in which case it weighs only 27 pounds.

The inventor of the compressed air ballast injector has spent many years in railroad maintenance work.

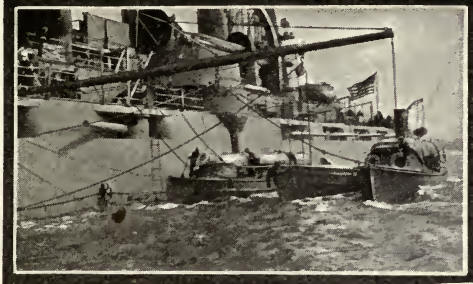
CURIOUS ACTION OF FALLING BODIES

Investigators have made some interesting experiments with falling bodies in the deep vertical shaft of a copper mine at Calumet, Mich., one of the deepest in the world.

The experimenters tried to drop into a box of clay 4,200 feet below two metal balls, two inches in diameter, one from the center of a shaft, nine feet wide and thirty feet long, and one from the southwest corner of it. Neither of the balls reached the box of clay. One was never found; the other, probably the one dropped from the center, was found lodged in the timbers of the east side of the shaft, 800 feet from the surface. In fact, bodies dropped into the shaft invariably lodged in the east wall, because the earth rotates on its axis from west to east. If a load of ore were spilled into the shaft, most of it would cling to the side of the shaft, or land on the levels to the east.

There is now in use a compression hammer that greatly reduces the labor of tearing up pavements — always a hard task, but especially so when the pavements are of asphalt or concrete. The hammer is driven by compressed air, forced through long pipes by a portable air pump. The workman has merely to hold the tool in place while the sharp-pointed hammer quickly cuts away the hard asphalt or breaks apart the hardest cobblestones. The saving in time effected by the use of this device is considerable.

REVIEW OF UNCLE SAM'S BATTLE FLEET



A gala week on the Hudson River at New York. Here the United States fleet of battleships, dreadnoughts, torpedo boats and destroyers, as well as the flotilla of submarines and submersibles was assembled for review during the week of May 8th.

The majestic fighting ships, supplemented with a gorgeous array of palatial private yachts, presented a spectacle against the picturesque New York skyline that will long be remembered by visitors to the review.

Photos. by Editorial Staff of THE WORLD'S ADVANCE.

SUBMARINES A CENTER OF ATTRACTION

Not the least interesting among the many sights for the visitor was the fleet of submarines. To the left is seen one of the latest models in our navy.

To the right may be seen a group of recently remodeled submarine torpedo boats in condition for cruising. The work of vessels of this type in the European war has given the little fighters a degree of importance hitherto unattained, and, as a result, the submarine flotilla has been a center of attraction during the review.

To the left: A group of United States submarines with their mother ship, a vessel of the monitor type. The monitors were originally intended for coast defense work and are capable of being partially submerged, although they are in no sense submarine boats.

To the right: An impressive line-up of the battleships and dreadnoughts of the United States Navy as far as the eye could reach greeted the visitor.

Photos. Copyrighted International News Service.

GLIMPSES OF LIFE ON BOARD SHIP

The lads of the Navy are natural born entertainers, and their hearty good fellowship has done much to enhance the interest of the public in our Navy and its workings. During the review visitors to the ships have been accorded a splendid reception. The Navy boys took pride in showing the visitors how the big guns and other fighting equipment are handled.

The illuminations have been gorgeous beyond description. Rows of incandescent lamps outlining the shapes of the vessels, the play of the searchlights, the fireworks—all have done their part in the celebration and helped to make the fleet as interesting by night as by day, if not more so.

Photos. Copyrighted International News Service.

A MANGLER WITH A SAFETY GUARD

One of the most dangerous features of a laundry is the mangling machine, which is used for pressing flat pieces. The mangler consists of two iron rollers, heated from the inside. The danger arises in the fact that the laundry worker, in feeding towels, napkins and other flat pieces between the rollers, becomes careless, and the fingers, or sleeves are drawn into the rolls and a serious accident results.

Among the various new appliances to be given a trial in the "safety first" movement of Cincinnati's new $4,000,000 hospital is a mangler in which safety is obtained for the laundry worker in the form of a little steel fence running along the entire length of the big roller. This arrangement effectively prevents fingers or sleeves from being accidentally drawn into the machine. All laundry machines in the new hospital are carefully screened and cog wheels guarded so that the possibilities of accident are minimized. Nearly $30,000 was spent by the city of Cincinnati to safeguard this laundry.

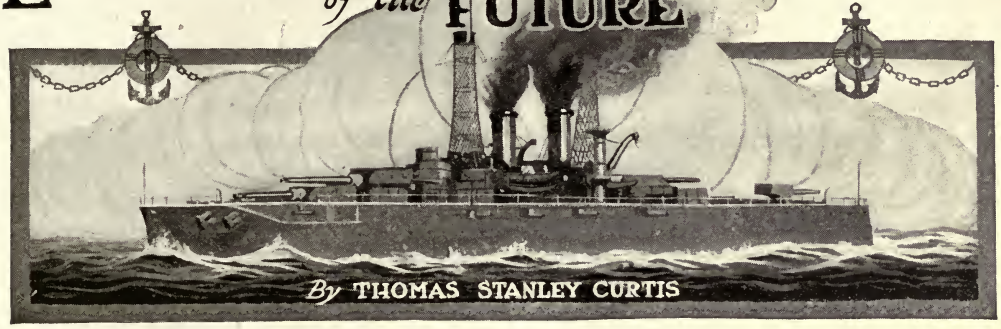
STEEL REINFORCING IN CONCRETE

Steel is always to be preferred to wood for reinforcing concrete, as both steel and concrete adhere together satisfactorily. Steel has also the advantage over wood in that it does not swell or shrink under the influence of moisture. It is also known that the safe working stress in long leaf yellow pine is about 1,200 pounds per square inch, while the safe working stress for mild steel is 1,600 pounds per square inch.

While wood is claimed to be quite satisfactory by some who use it for this purpose, there is considerable controversy in this matter. It would seem that for big concrete work the steel reinforcing should unquestionably be used.

A Little Steel Fence Along the Entire Length of the Roller Prevents the Worker's Fingers from Being Caught in the Mangle or Ironing Machine.

ELECTRIC DRIVE *for the* BATTLESHIP *of the* FUTURE



By THOMAS STANLEY CURTIS

WHEN first one hears of electric propulsion as applied to a modern dreadnaught, the thought which instantly forms itself is that the system must be inordinately complex and costly; furthermore, it would seem to introduce the combined losses of a turbine, an electric generator and an electric motor. The utter fallacy of this hasty conclusion is readily seen when the facts presented herewith are digested. How the United States Government is building the world's first electrically driven battleship—and this at a saving of some $200,000, together with a significant gain in operating efficiency—is told in the accompanying article, which was secured expressly for THE WORLD'S ADVANCE.

THEY do say it is bad form to start an article with an apology; just for that, let us decline to admit that this first paragraph is an apology—let us call it, instead, an explanation. When the writer went forth in search of information bearing upon the new battleship *California,* the primary object in view was to secure the details of her electric drive—a radical departure in propulsion mechanism. Before the quest for data was finished, the interviewer realized that battleship-building and ship-building are two separate and distinct trades. In other words, he was given an intensely interesting glimpse of the stages through which one of our gigantic fighting ships must go before a rivet is driven in her hull. Therefore, at the risk of being accused of a digression from the subject suggested by the title of this article, he endeavors to take the reader, in imagination, through the enormous planning rooms of the New York Navy Yard, where the *California* is at this writing undergoing the first steps in her construction. But first of all, lest the digression be too pronounced, let us stop to consider the ingenious arrangement of the driving mechanism which is to put this monster craft in a class by itself.

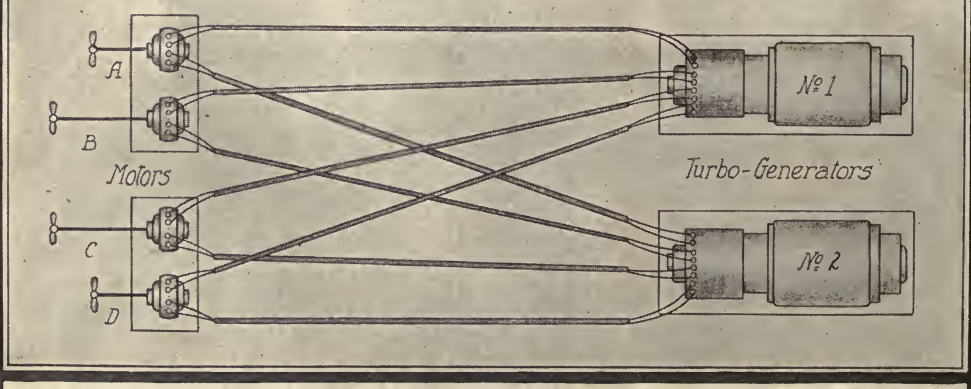
The steam turbine has long been conceded to be the ideal source of motive power for heavy marine work; it is subject to certain limitations, however, which detract from its value. For in-

stance, while the turbine operates at its highest efficiency when driven at a very high rate of speed, the screw propeller of the ship attains its maximum efficiency when turning at a speed approximating one hundred revolutions per minute. This means the introduction of gearing or some other mechanism to reduce the speed of the turbine to that best adapted to the propeller. Added to the cost of this mechanism is its liability to damage, for the transmission of several thousand horsepower of mechanical energy is no small problem to contend with. Furthermore, the steam turbine runs inherently in one direction only. If it be made reversible, the rotor must be in duplicate, which means that not only must the working rotor drive the propeller but it must also carry around the idle rotor. The only other alternative is in the installation of a second set of turbines for backing purposes only and the tremendous cost of this system is obvious. Flexibility of control in both backward and forward movements is of the highest importance in the fighting ship and for this reason the builders have been forced to employ a driving mechanism embodying every possible feature of advantage regardless of the cost of installation and subsequent operation.

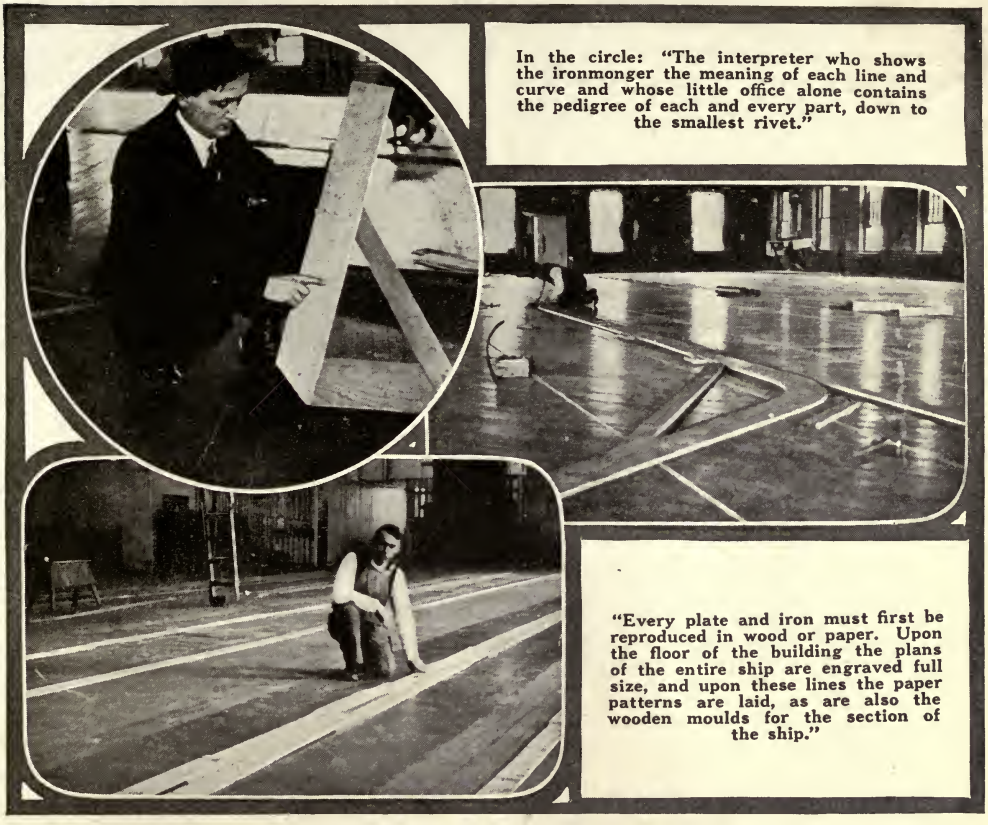
Another essential in the propulsion of a battleship is that it shall be capable of cruising day in and day out at a speed of some fifteen knots per hour and at the same time be able to make a sudden, though perhaps long-continued, spurt at its maximum speed of twenty-two knots. The turbine is essentially a one-speed machine. As remarked before, its ideal operating speed is a high one. In order, therefore, that it be made capable of attaining the higher speed, it must be operated for the greater part of the time—*i. e.,* while cruising, at comparatively low efficiency.

The great flexibility of control found in the electric motor admirably adapts it to the purposes of ship propulsion. The speed, moreover, is in accordance with that at which the propeller should be driven. Granting this, the problem has been to so combine the motor with a generating unit that the very utmost of efficiency could be realized at all times and under all conditions from each individual unit of the entire plant. Apparently this result has been secured in the system under our consideration. The original installation of the kind was placed in the U. S. collier *Jupiter* some two years ago and during the interim there is not a single case of electrical trouble on record although the ship has been in practically constant and trying service.

An examination of the simple diagram which is reproduced on this page will serve to make clear the plan of the



Two turbo-generators, operating either independently or in tandem, supply the current which operates the electric motors that drive the propellers.



In the circle: "The interpreter who shows the ironmonger the meaning of each line and curve and whose little office alone contains the pedigree of each and every part, down to the smallest rivet."

"Every plate and iron must first be reproduced in wood or paper. Upon the floor of the building the plans of the entire ship are engraved full size, and upon these lines the paper patterns are laid, as are also the wooden moulds for the section of the ship."

driving mechanism. The generating plant is composed of two independent turbo-generators, each of which is capable of delivering one-half of the total power necessary to run the ship at her maximum speed. The driving motors are of the three-phase variety and each motor is equipped with two sets of pole pieces—one of twenty-four poles and the other of thirty-six. The electrical reader will understand that by operating the motors on one or the other set of poles, the speed is changed without impairing the efficiency in any way. The plan of operation is to drive the motors at the lower speed for cruising with only one turbo-generator in operation, while for the greater speed the two generators would be operated in tandem with the motors arranged to run at their maximum speed. Thus it will be seen that when cruising, the one generator is running at its full efficiency as are also the motors, while the second generator is idle. Likewise, when full speed is required, the second generator is started and run also at its peak of efficiency.

The installation on the *Jupiter* does not combine the feature of a double turbo-generator, but in all other respects it may be said to correspond with the plant to be installed in the *California.* Hence, it is safe to assume that with the added safeguard of a duplex generating unit, the drive for the *California* will fulfill all of the expectations of the designers.

Having elicited the foregoing information relative to the propelling mechanism of the new vessel, the writer ventured an inquiry as to when the actual work upon her would be started. To his surprise the answer came that the preliminary work had been going on for six weeks past and that the moulds for the keel were being laid. Now, to the green landlubber this statement brought up a mental picture of enormous traveling cranes lifting into position huge pieces of material in the ship-

yard and the natural curiosity to see what was going on impelled the investigator to turn toward that portion of the Navy Yard where Uncle Sam's big fighters come forth.

After dint of much fruitless inquiry, the writer found himself in the hands of a kindly-spirited individual who bore the official title of the "planner" and to whose kindness and generosity the reader is indebted for the insight into the mysteries of battleship building the writer is enabled to give. The guide escorted his visitor to an enormous building which instantly gave the impression that it was a gigantic ball room the moment we entered the door. A closer inspection of the polished floor, however, disclosed a bewildering array of curves and lines, each of which bore a number or letter. Entering the modest office, the guide explained that he would introduce the man who laid the moulds for the splendid dreadnought *Arizona,* at the time resting on the ways and almost ready for the launching. Incidentally, the same man bears the responsibility for the pattern from which each and every plate and iron in the *California* is to be made. The man who shoulders this burden proved to be young, quiet and unassuming, but with an air of confidence born of knowledge in his work and the men under him.

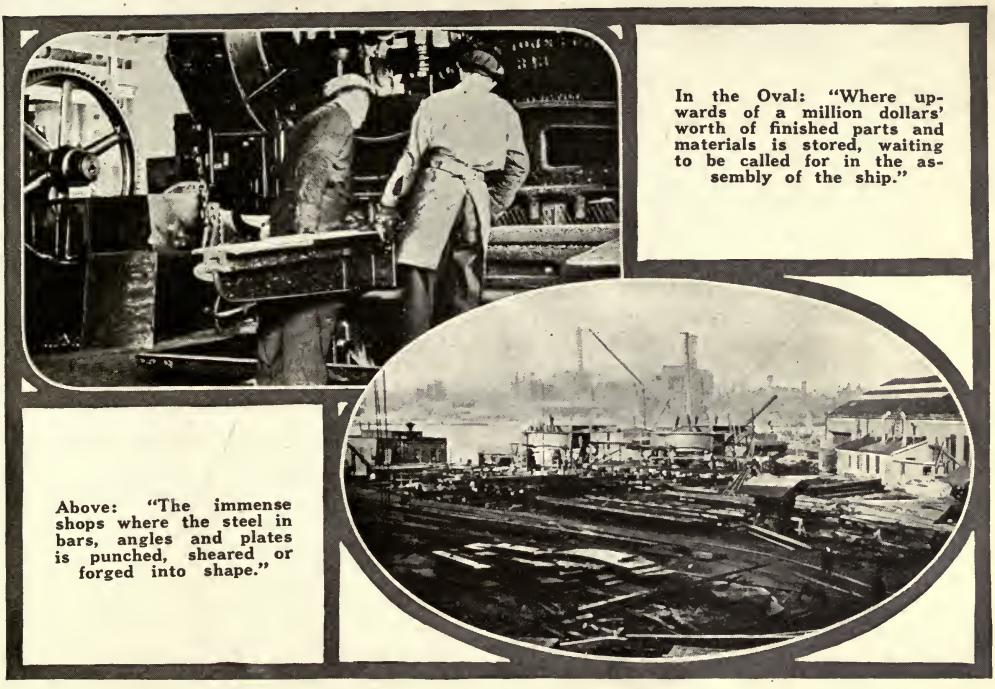
Every plate and iron, so my new guide explained, must first be reproduced in either wood or paper. Entering again the "ball room" of my imagination, the guide pointed out how the floor of the building represented a gigantic drawing board upon which the plans of the entire vessel are engraved in the full size of the finished ship. Upon the lines in the floor the paper patterns are laid for the plates as are also the wooden moulds for the sections of the ship.

The importance of this system can readily be appreciated when it is stated that a saving of some $50,000 has been realized in the building of a single battleship through the elimination of errors in the ordering of materials. Furthermore, the plan enables the work of the draftsmen to be positively checked and many expensive errors are avoided in consequence.

From the main planning room the visitor was conducted to a smaller one

Below: After having been marked from the patterns, the plates are cut to their required shape by means of an oxy-acetylene blow-pipe.

Above: "The raw materials are marked from the patterns in one big room and passed through to the shops, from which they issue, bearing identifying numbers, to the storage yard."



In the Oval: "Where upwards of a million dollars' worth of finished parts and materials is stored, waiting to be called for in the assembly of the ship."

Above: "The immense shops where the steel in bars, angles and plates is punched, sheared or forged into shape."

in which the *California's* keel was being laid. For the keel moulds, long wooden strips were used and in each piece the holes for the rivets as well as depressions for the several straps which cross the keel were clearly indicated. An interesting point in connection with the making of the patterns and moulds was brought out by an inquiry as to the effect of moisture on the accuracy of the mould. The planner explained that the difficulties were many; in the case of a keel piece twenty-eight feet long, the length in very damp weather would increase by an inch and a half. In such a case it is necessary to dry the strip until it measures the correct length by steel tape prior to its application to the steel to be laid out.

From the plan rooms the writer was conducted through the immense shops where the steel in bars, angles and plates is punched, sheared or forged to shape. The raw materials are marked from the patterns in one big room and passed through to the shops from which they issue, bearing identifying numbers, to the storage yards. As a fitting close to a most interesting tour, my guide pointed out of the window to the yard where, in his words, "is stored at times upward of a million dollars' worth of finished parts and materials, each piece bearing its number, and waiting to be called for by the section foremen as it is required." Truly, the building of a battleship is more than a matter of drawing the plans and riveting the plates and irons together. My hat comes off to the man who shapes each piece—the interpreter who shows the ironmonger the meaning of each line and curve, and whose little office alone contains the pedigree of each and every part, down to the smallest rivet, of some of our mightiest dreadnaughts.

STEEL TOWERS FOR GOVERNMENT RADIO STATIONS

Twelve steel wireless towers have recently been completed for the United States Government. Eleven out of the twelve are 300 feet high. The shortest one, which is 200 feet high, has been sent to Beaufort, N. C. Two of the towers were shipped to Washington, D. C., two to Boston, four to the Canal Zone and three to a point in the West.

These steel towers will be employed in the wireless stations that are to form the links of a powerful chain of Government stations, now being arranged.

TIDAL TRANSPORTATION

Some of the finest grindstones in the world come from the bottom of the Bay of Fundy. The stonecutters there have a simple method of moving them to the shore. Workmen quarry the stones from the solid rock when the tide is out, and fasten them to a large flat-bottomed boat. The tides in the Bay of Fundy are the highest in the world; they rise from 50 to 70 feet, and rush in with great swiftness. The tide lifts the flatboat with the stones attached; the workmen bring the boat ashore and remove the stones at their leisure when the tide is out.

STARTLING ADVERTISING

A man dangling by his hands from the roof of a building is apt to startle passersby and cause them to stop and almost call for help. It invariably makes a man pause long enough to investigate. This fact has been adopted by a western firm in conjunction with its advertising. In these days when so much advertising is done by billboard, it takes either a very clever or startling device to attract the attention of the passerby and take his thoughts away from his own affairs.

A Dummy Figure Dangling from the Eaves of a Roof and Carrying an Advertisement Makes the Average Passerby Pause Long Enough to Investigate.

A CENSUS OF POLES

The 900,000 miles of telegraph and telephone wires that now form a vast network over almost every part of the United States and Canada require the support of no less than 35,000,000 poles. It is said that about four million poles are needed annually for renewals and new lines. Well-stocked German forests, which are the best managed forests in the world, produce only 250 trees to the acre; the poles now standing would thus represent all the timber growing on more than 130,000 acres. In Canada considerably less than one hundred poles are cut to the acre, so that nearly 500,000 acres of forests have been cut to obtain the poles now in use, and about 50,000 acres are cut over each year to furnish the poles for renewals. That means cutting at the rate of a hundred acres a day.

A TWENTY-YEAR CALENDAR

While there are a multitude of calendars in existence which enable any one to determine a desired date ten, twenty or even a hundred years hence, there are but few of them that are ready for instant use. Most of them require considerable figuring, tabulating or the moving of shifting scales in order to secure the desired date.

A Brooklyn man has recently published a twenty-year calendar which has for its main feature extreme simplicity. Any date can be found immediately, and it is so simple that even a child can consult it.

PANAMA PACIFIC EXPOSITION NOTES

by H.A. EVELETH

THE details of the fire-patrol system, employed in the National Forests under the supervision of the Department of Forestry, are disclosed in an interesting exhibit in the Palace of Agriculture. The paramount feature is a reproduction of one of the fire-lookout structures with the customary equipment of signalling apparatus. These observation towers are located on the higher mountain peaks where an unobstructed view may be had of the surrounding country, one or more of the other towers and if possible the office of the supervisor; the last named being the central station and headquarters of the system. The different stations or look-out towers and supervisor's headquarters are inter-connected by telephone and thus the presence of a fire in the forest may be brought to the attention of the latter in a minimum of time. The essential piece of apparatus on the observation platform is the fire locator, which consists of a map of the surrounding country, an alidade and a protractor. The alidade consists of a metal bar bent so that it forms three sides of a rectangle, the longest side, about twenty inches in length, serving as a base for the instrument, while the two shorter sides stand upright from the base and serve as a means for its orientation; the one having a narrow vertical slit and the other a wider vertical slit along the center of which is stretched a vertical wire. The base is pivoted, near the end bearing the narrow slit, at the center of the map. In use, the alidade is oriented until the eye of the observer, the rear slit, the vertical wire and the smoke from the fire are in line. The angle between this position and a predetermined base line is then read and telephoned to the supervisor. In the meantime a similar process has been going on at one or more of the other look-out stations and the observed angles are telephoned to the supervisor. Here is located a map similar to that used by the lookout men and, knowing the position of the lookout stations and any two of the observed angles, the location

of the fire may be readily determined and the necessary action taken to prevent it from spreading. The observation stations are also equipped with a field-glass, a heliograph which serves as an auxiliary to the telephone, and a portable telephone. The last named may be put into commission by merely grounding one terminal and connecting the other to the main telephone line.

The fire-fighting tool box, a cylindrical, galvanized-iron object, next attracts the visitor's attention. It is about six feet high by three feet in diameter and access to the interior is by means of a hinged door built into the side. These receptacles are painted red and, together with weather-proof iron-box telephones, are placed along the routes of travel followed by patrolmen and campers. The equipment of the fire-fighting tool box consists of several axes, saws, picks, rakes and shovels; a lantern, a kerosene torch for backfiring, a carbide light for fighting after dark, water-bags and a compact set of cooking utensils for four men.

The following six golden rules for fire prevention are posted conspicuously about the exhibit: (1) Be sure your match is out. Break it into two before you throw it away. (2) Don't throw away burning tobacco. (3) Make your campfire small and in a safe place. (4) Put out your fire with water and then cover it with earth. (5) Don't make large bon-fires. (6) If you find a fire, put it out; if it is too big, notify a ranger.

A novel exhibit in the Palace of Education is that consisting of a huge relief map of the state of New York on which are shown, by means of miniature electric lamps, the location and classification of all the educational institutions in the state. The map is approximately twenty-five by thirty-five feet in size. Each class of schools is represented by a certain color of lights and the various colors flash on and off in definite order. The elementary schools are represented by 12,138 white lamps, 496 of which are huddled together in New York City. Over fourteen thousand lamps are used in the exhibit.

The fire assay laboratory of the U. S. Bureau of Mines in the Palace of Mines and Metallurgy is employed to demonstrate the fire assay method of determining the value of gold and silver ores. The ore to be tested is pulverized and mixed with a flux (soda litharge borax) which aids fusion. Granulated lead is now added to the mixture, the whole is placed in an earthenware crucible and the latter with its contents is put into an oil-burning furnace of the Braun-Muffle type. Fusion takes place at about 1600 degrees F. and the liquid mass is poured into a conical-shaped mould to solidify. The slag, containing the waste materials of the ore, rises to the top, while the heavier lead settles to the bottom, forming what is called the lead *button.* Lead has a property of absorbing gold and silver, when in a molten state, and hence all the gold and silver formerly contained in the pulverized ore is now present in the lead button. The slag is broken away from the button and the latter is placed in a *cupel* and put into the furnace where it attains a temperature slightly above the melting point of lead. This cupel is made of a mixture of bone ash and cement and has a property of absorbing liquid lead at "red heat," while gold and silver are not affected. Thus the lead of the button is oxidized, and absorbed by the material of the cupel, and a small globule of gold and silver remains. These two metals are next separated by dissolving the silver in nitric acid. The final speck of pure gold is placed on a balance having a sensitivity of six millionths of one ounce, and, by a comparison of its weight with that of the pulverized ore tested, the "run" of the ore is computed and its value determined.

He who is wandering about in the Palace of Liberal Arts will be attracted by the sight of a monstrous typewriter. This prodigious machine is 21 feet long by 15 feet wide and is, in detail, an exact reproduction of one of the standard typewriters manufactured by the owners of the exhibit. It is 1728 times larger than the standard, weighs 14 tons and was built at a cost of $100,000.00. The carriage weighs a ton and a half, the key cups are seven inches in diameter and the printed letters are three inches high.

It is operated from the keyboard of a standard machine located on a desk a few feet in front. The keys of the two machines are connected electrically and the motive power for the larger is obtained from electric motors. The operation of typing is necessarily slow, but the machine serves admirably for attracting the attention of visitors.

One of the features attracting considerable attention at The American Pulley Company's exhibit in the Palace of Machinery is the demonstration which shows the perfect balance of all "American" pulleys. A large 72-inch diameter by 36-inch face, triple arm, steel split pulley, weighing approximately 1,500 pounds, is turned with perfect ease by a thread of the finest silk. The pulley is in such perfect balance that no starting other than that of the motor is necessary to put it in motion. In other words, the silk thread is capable of taking care of the starting load. A new device called an "Efficiency Indicator," measuring accurately to 3-1000 of a h.p., shows the exact amount of horsepower required to revolve any pulley.

The U. S. Weather Bureau maintains an instructive exhibit in the Palace of Agriculture. The first instrument of interest is a seismograph, used for recording the undulatory motions, duration and direction of an earthquake. It consists essentially of a horizontal arm several feet in length, attached to a vertical upright in such a manner that it is free to oscillate in a horizontal plane. A heavy mass is placed at the outer extremity of the arm to damp the vibrations. The magnitude of oscillation is magnified by a mechanical system of levers and the seismic tremors are recorded by a pen on a slowly revolving sheet of paper traveling at right angles to the direction of oscillation. The vibration of the floor, due to a person approaching the instrument, causes the recorder to move through an arc of several inches.

The next instrument, a pyrheliometer, is used to determine the amount of insolation or radiant energy received from the sun at place of exposure. A cloud nephoscope is of interest in that it measures the azimuth, angular velocity, direction of motion and apparent velocity of motion of the cloud under observation.

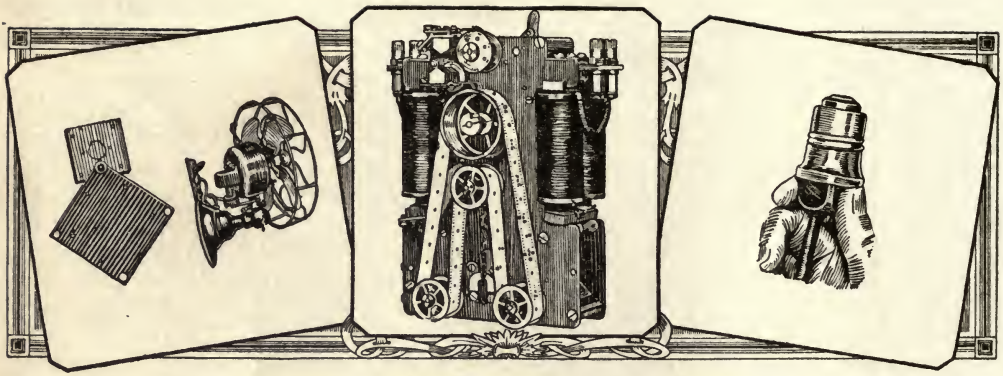
A kite meteorograph is used for recording four conditions of the atmosphere. One pen actuated electrically by the kite anemometer traces a record of the velocity of the wind, a second pen traces a record of the temperature of the air, and a third pen traces a record of the percentage of moisture in the air. The meteorological balloon tugging away at the floor is also of interest. It is about four feet in diameter and carries a small wicker-work basket in which is placed the balloon meteorograph. This instrument has recorded a temperature of minus 92 degrees F., an altitude of 20 miles and a horizontal distance of over 260 miles.

A snow sampling tube and weighing scales are used for determining the water contents of a snow layer and the approximate number of acre-feet of water in the form of snow on any water shed. The weekly floating rain gauge makes an automatic record of the beginning, ending, rate and amount of every shower of rain during the period of a week and requires attention but once in such period.

Other instruments shown are anemometers, for measuring the velocity of the wind; airmeters, for measuring drafts; psychrometers, for measuring moisture; hygrographs, which write the relative humidity for the week; barographs, for recording air pressure; and thermographs, maximum and minimum thermometers, aneroid and siphon barometers, evaporimeters, rain gauges, snow stakes, river stage indicators and weather charts.

The smallest electric motor and steam engine in the world are on display in the North Dakota state building. They are the work of Mr. Ivan T. Nedland of that state and documentary proof is given as to their actual working ability. The motor runs by the current from a dry cell, while the engine is operated by compressed air.

If you enjoy THE WORLD'S ADVANCE, tell others; if not, tell us.



Bracket Fan Hanger. Bell Ringer and Whistle Blower. Single Turn Attachment Plug.

Recent and Improved Devices

Fixture for Hanging Bracket Fans

With the approach of summer and electric fan season many electrical manufacturers are introducing not only fans but fixtures for use in connection with them. One of the most practicable of these is an adapter plate which can be used in conjunction with a special outlet box.

As shown in the sketch, the outlet box cover is provided with a bolt that serves to hold the adapter plate. The bolt passes through the upper screw hole of the plate as well as through a hole in the rim of the fan base, at a point opposite the fan switch. Both the plate and the fan are held in place by a washer and nut placed on the bolt. It is a simple matter to remove the fan at any time for cleaning or repairs.

Ringing Bells and Blowing Whistles Automatically

It will no longer be necessary for some one person to keep a watch on the clock and always be on hand to blow whistles or ring bells at certain times, for there has been placed on the market an equipment which takes care of these tasks. The device is an electrical one and functuates by means of a perforated paper ribbon.

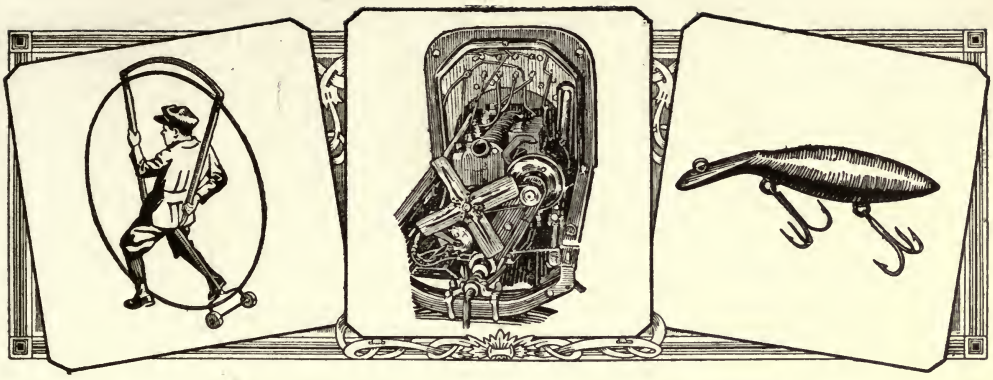
The automatic bell-ringing and whistle-blowing device or program instrument is operated by electric current. It has no delicate parts to get out of order. The schedule is controlled by a paper tape which is printed in divisions of time and punched at the points where contact is to be made. Each tape can take care of two schedules. The instrument will automatically change and operate the same signals on different schedules on different days, and will automatically cause any schedule to remain silent on any day or days desired. If it is desired to change schedules on account of seasons or other causes, such changes can be made in a few moments by the substituting of a fresh tape punched for the new schedule. The program instrument is connected in a circuit controlled by a master clock, which sends out minute impulses.

A New Type of Attachment Plug

A new type of attachment plug has recently made its appearance and which has for its main feature extreme simplicity and convenience. It can be placed in any receptacle with but a single turn.

As may be seen in the illustration, the

Space does not permit these interesting devices to be described at greater length. However, any reader desiring more detailed information concerning devices described in these columns can secure it upon request.



New Sport for Boys. Electric Self-Starter. Fishing Bait of New Design.

new plug has a cylindrical shell with a short thread instead of the usual screw shell with many threads. Furthermore, the center contact member is fitted with a spring which exerts sufficient pressure on it so that the plug is firmly held in a receptacle and at the same time establishing good electrical contact. The plug will not loosen from vibration, and it may be taken out of a receptacle without arcing.

A New Sport for Boys

What promises to be a most popular sport for boys is offered by a recently devised type of vehicle known as the "unicycle". In reality, this vehicle consists of a large hoop on which is mounted a framework carrying the seat and provided with two smaller wheels. The hoop is made of one-half inch gas pipe welded into a ring, while the framework is of durable wood.

The unicycle affords much fun to the boys and is a sport that is entirely unique and incomparable to existing ones. Its main use is for coasting, in which it is possible to attain high speeds. The rider rests on the seat and keeps his feet off the ground. The small wheels are also raised off the ground so that the rider is actually being carried by the hoop alone. The device is so light that it can be immediately controlled by placing the feet on the ground, either to steer it or slacken the speed, as well as to bring it to a stop.

The unicycle is made in three sizes, the smallest having a 48-inch hoop, the next a 54-inch hoop, and the largest a 60-inch hoop. The respective weights of these various sized machines are 22, 23 and 25 pounds. There is nothing fragile in the construction of the unicycle, and anyone weighing even in excess of 150 pounds can safely ride on any of the models.

An Electric Self-Starter

One of the leading electrical manufacturing companies has recently placed on the market an electric self-starting and lighting system for Ford cars.

The principal member of the system is a single electric machine which is used both as the generator and motor. It is wound for twelve volts and is employed in conjunction with a six-cell, 42-ampere hour battery. This battery serves the function of starting the car as well as furnishing current to the head, side and tail lights.

The motor-generator member of the equipment weighs about 52 pounds and is supported rigidly on the right-hand side of a Ford engine by means of a pressed steel bracket secured at three points. The storage battery is carried on the right-hand running board of the car. When the automobile has attained a speed of about eleven miles per hour, the electric machine acts as a generator developing an electromotive force suffi-

Water Heater and Radiator. Attractive Table Fan. Electric Water Heater.

ciently high to overcome the normal voltage of the battery and permit charging to take place. At this point, the reverse current relay operates, closing the circuit between the generator and battery. Charging then begins at a low rate, the current gradually increasing as the speed of the car is augmented, until the current reaches a maximum of slightly over ten amperes.

Fishing Bait of New Design

Having the dip, dive, wiggle and swimming motion of a live minnow in action, a new design of bait recently placed on the market is proving very popular with the fishermen. This bait is of a peculiar design and made of wood. The line is attached to a screw eye, and the hooks, acting as ballast, cause the swimming motion of the bait to resemble that of a live minnow. The bait is said to be ideal for trolling and casting. When not in action, it comes to the surface, thereby avoiding the possibility of catching on the bottom or the entangling of the line. The hooks being placed behind the body of the bait causes it to be practically weedless. When being drawn through the water the bait sinks immediately to a depth of from eighteen inches to two feet, according to the tension on the line.

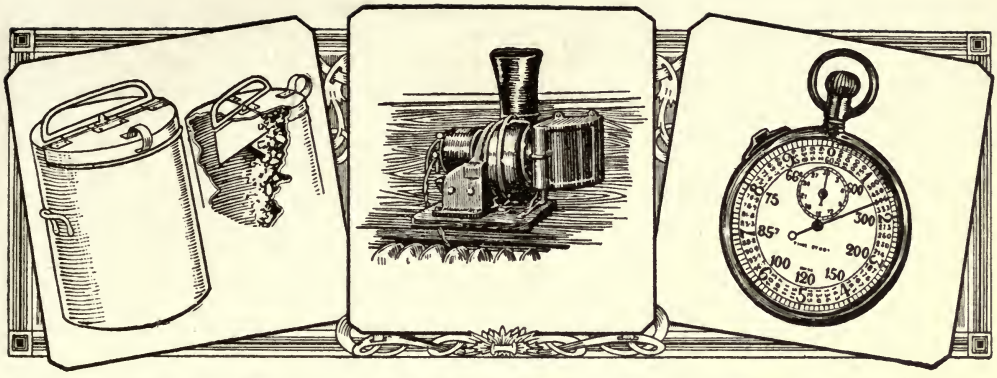
It is said that remarkable results are being obtained with this form of bait, due to its peculiar action when drawn through the water.

Electric Radiator and Water Heater

An electric radiator has recently been placed on the market by a western manufacturer. In general appearance the radiator resembles the conventional hot-water type and is filled with a circulating medium. The heating elements are inserted through the top and bottom of the radiator. In order to provide a range of different temperatures, the heating element is divided into several sections which may be connected to a multiple switch either mounted directly on the radiator or placed at some remote, convenient location. The radiator is very economical in operation, consuming but 30 watts per square foot of radiating surface on high heat, 15 watts on medium heat and 8 watts on low heat. Current for operating the heater can be taken from any lighting circuit of the proper voltage, thus insuring a source of heat that is available at any time without any more trouble than the turning of a switch.

An electric hot-water heater suitable for domestic purposes has also been introduced by the same manufacturer. It is made in the form of a metal tube containing a high resistance heating coil. The entire device requires but little space, measuring 3 inches in diameter by 30 inches high, and can be installed for the heating of water in any sized tank from 30 to 30,000 gallons capacity.

If THE WORLD'S ADVANCE pleases you, tell others about it; if not, tell us.



Odorless Garbage Can. Electric Ventilating Equipment. Improved Stop Watch.

A Table Fan of Attractive Design

A table fan of radically new design is now available. The original feature of this fan is that it is so constructed as to permit of placing a dish on top of it, thus making it unnecessary to devote valuable table space to it, and also giving it the ornamental appearance of a pedestal.

The table fan is of the universal type and can be operated on either direct or alternating current of any frequency. It is being made for use on circuits of from 100 to 220 volts. The fan is provided with a three-speed regulating device for controlling the amount of breeze. The operation of the motor is said to be noiseless.

Hot and Cold Water from the Same Faucet

An electrical device for heating water, which has recently been placed on the market, makes possible the securing of hot and cold water from any faucet. The device is attractively finished and may be attached to any faucet.

The electrical water heater is 12 inches in height and is made to be connected immediately to any cold water faucet. Two wires are provided for connection to an electric circuit. By turning the handle of the device to the right or left, it is possible to secure cold or hot water instantaneously. The temperature of the hot water is controlled by the rate of flow. If boiling water is desired, the faucet is turned but a trifle so that the water will take a longer time to flow through the heater, and intermediate temperatures are secured by a proportionately slower flow. The advantage of the hot water heater is that it saves plumbing expenses since it is only necessary to run piping for the cold water.

Making the Garbage Can Odorless

With a view to making all garbage cans both odorless and sanitary, an American inventor has perfected a lid that has many advantages. The patented lid does much to give a garbage can a more attractive appearance and make its use more agreeable.

The device is made in the form of a high lid that fits on any garbage can. At the top is a handle that may be turned completely around, as well as a hinged cover. Inside the lid is a metal shelf that extends over just one-half the area of the can, as well as a metal blade that is pivoted to the shaft of the handle and made so as to be turned around at will.

The action of the odorless lid is quite simple: The lid may only be opened when the handle is not covering it and consequently when the metal blade is in such position as to shut off the shelf from the lower part of the can. After the garbage has been placed in the upper compartment of the can, the handle is turned, with the result that the blade

turns, pushing all the garbage that has been placed on the shelf into the can. In order to empty more garbage into the can it is again necessary to place the handle in the right position, and when the lid is lifted the shelf is again found perfectly clean.

Equipment for Hygienic Ventilation

The Chicago ventilation commission some years ago came to the conclusion that ventilation with cold outdoor air is impracticable owing to the tendency of very cold air to resist diffusion with the warmer air of the room. The air warmed by the radiators goes to the ceiling, while the cold air falls to the floor.

A new design of ventilator just placed on the market overcomes the foregoing-mentioned difficulty in two ways: First, by blowing the cold air to the ceiling with sufficient velocity to cause it to creep along the ceiling until it falls away in all parts of the room, and, secondly, when the weather is very cold (below 25 degrees Fahr.) by mechanically mixing enough warm air to bring the temperature of the mixture to a normal coolness (about 30 degrees Fahr.). The result is that a uniform temperature exists from floor to ceiling and absolutely no drafts are felt; in fact, it is impossible to feel that cold air is coming into the room.

The ventilator consists of a motor-driven blower fitted with a combined duct and mixing chamber for bringing outdoor or indoor air to the blower, or a mixture of the two sufficient to maintain a comfortable atmosphere in the room. When the slide in the duct is brought forward the blower draws only cold outdoor air; while on the other hand, when it is pushed back, the cold air from the room is recirculated. When the slide in the duct is open half way the result is that both outdoor and indoor air are taken into the mixing chamber and passed through the blower. By adjusting the slide any temperature can be had at the nozzle, between the outdoor and indoor temperatures. The cold mixture upon being blown to the ceiling, spreads out against it, and, after losing its momentum, gradually sinks through the warm air and is breathed by the persons in the room.

The ventilating equipment is operated by current taken from the ordinary socket. No special wiring is necessary. It can be installed or removed in a few minutes, and the placing of the window board in the window frame, which serves to hold it in place, causes no damage to the woodwork.

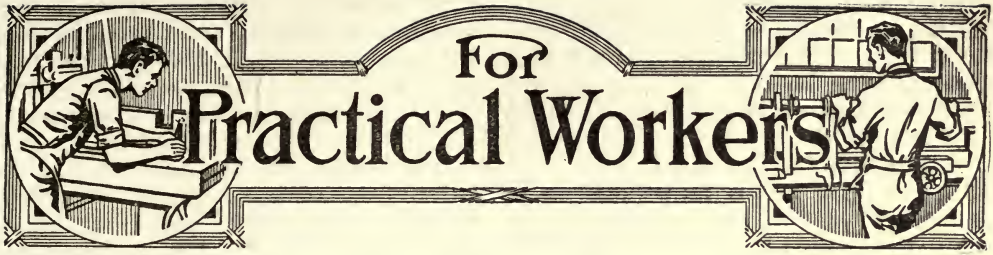
A Watch for Studying Time

Modern efficiency methods as applied to factories and shops often make it necessary to study the time required for different operations in the manufacture of certain products. For this work it is absolutely necessary to have a stop watch. However, the conventional stop watch leaves much to be desired for the reason that, while it gives the time elapsed for a certain operation, it is necessary to indulge in considerable calculation for determining the output per hour or day.

A time-study watch of new design has recently been evolved for the purpose of eliminating all computation and making it possible for an observer to read from the dial the quantity desired. The circumference of the dial of the watch is divided into 100 parts, as in the well-known decimal dial, but instead of these divisions being numbered in the ordinary manner, they are marked with figures which indicate the number of operations per hour, when the time of a single operation is represented by the elapsed time. In the instance of very short operations, ten operations instead of one can be timed and the figure read off the dial is then multiplied by ten.

The hand of the watch can be started or stopped by pushing a lever at the side. The hand can be returned to zero by giving the crown a push.

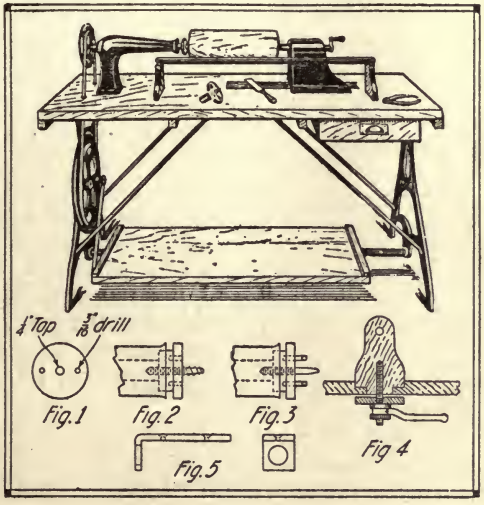
A device for counting persons entering street cars, which operates by means of an electrical mechanism connected to the steps, has recently been patented by two Wisconsin inventors.



WOOD-TURNING LATHE MADE FROM A SEWING MACHINE

By Harvey N. Bliss

A serviceable wood-turning lathe can be made from an old sewing machine. The arm of the machine should be cut off near the end and any fixtures removed, leaving only the spindle, which has a two-inch plate on one end and a wheel on the other. The plate should be drilled with three holes, as shown in Fig. 1. The center hole should be tapped out with a ¼-20 tap, to accommodate a screw center made from an ordinary wood screw the head of which is cut off and the shank threaded with a ¼-20 machine thread. When a live center is required, three points should be fitted into the hole, the outside two having screwdriver points and the center one a tapered point, as shown.



Figs. 2 and 3 show the screw and spur centers. The headstock is now complete, and for the reason that it has a large iron base it can be set firmly on the bed of the lathe.

The bed, which should be made of inch boards, should measure about 4 ft. x 2 ft., with a 2-inch base running lengthwise from the headstock to the opposite end. Another layer of inch boards should then be nailed on. These should be chiseled out on the under side so that they will fit over and cover the large iron base. A 4-inch space should be left in which the tail stock will slide.

A wooden tail stock will serve very well. It should be built up of boards shaped roughly at first, then fastened tightly together and smoothed. It may be held at any desired place by a board about 4 in. wide and as long as the tail stock. This should be hinged at the back to the bottom of the tail stock and provided with a bolt having a handle passing through at the front into an imbedded nut in the tail stock. The dead center can be made of a bolt, pointed at the end, turning through two imbedded nuts, with a small wheel or handle of some sort at the head. The cross sectional view, Fig. 4, shows the tail stock, the groove in the bed and the method of locking.

The bed should be supported by the cast iron braces of the sewing machine. However, these should be placed about 3½ feet apart and braced with several ½-inch iron rods. The old rod which crossed the bottom will be too short, so it should be cut in half and the two pieces driven into a 3½ foot length of gas pipe so that only the threaded ends

protrude.

A treadle should be made of wood and fastened to the bar by two drill braces, as is indicated in Fig. 5. The bar should be made rigid by pins set in holes drilled through the pipe or by thick washers with set screws.

A good tee rest is rather difficult to construct properly, but a section of pipe or rod supported by a block at each end at the correct height will answer the purpose very well. The supports should be 6 in. long and fitted with strips of brass along the top.

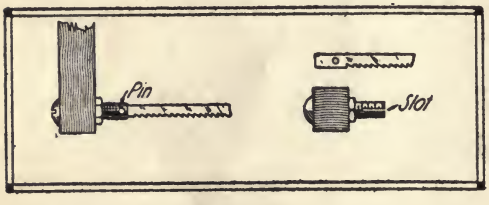
Holes should be drilled through each end of the pipe, and pins passed through the pipe into the supports. By changing the pins the rest can be moved back and forth. When a rest at right angles to the one mentioned is required, a block of wood, shaped roughly like the tail stock, and sliding in the same groove, should be used.

The speed of the lathe will not be more than 1,000 r.p.m. with the treadle alone, but by running a belt from the lower wheel to a small pulley attached to a bicycle wheel, a much greater speed may be obtained.

This lathe, although, of course, not adapted to heavy work, will prove very useful for all sorts of wood turning as well as grinding, polishing and light metal turning.

To Lock a Scroll Saw Blade

A scroll blade may be fastened securely to the guide arms by boring holes into the ends of the arms large enough



to admit stove bolts. The threaded portions of the bolts should be slotted with a hack saw and drilled with small holes at right angles to the slot. A pin should be inserted through these holes and through the holes in the ends of the saw blade.

Contributed by

WM. HALK.

Shoe Polish on Woodwork

Black wood cabinets that have lost their lustre can be restored to their original brightness by the application of shoe blacking paste, followed by brisk rubbing with a flannel cloth.

Contributed by WALTER G. CHICK.

A Funnel to Hold Twine

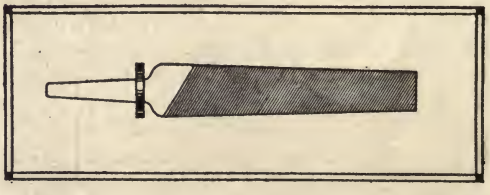
A ball of twine is always handy—if it can be found when needed. A funnel provides a very simple holder for keeping the ball in its place and preventing the string from becoming entangled. Three holes should be punched at equal distances around the rim and lengths of twine passed through, knotted together and hung from a nail or hook. The end of the twine should be pulled from the middle of the ball and passed out through the stem of the funnel.

Contributed by

H. J. GRAY.

Washer Prevents File Handle Splitting

A small washer driven on the tang of



a file will act as a stop for the handle and prevent it from splitting.

Contributed by WM. HALK.

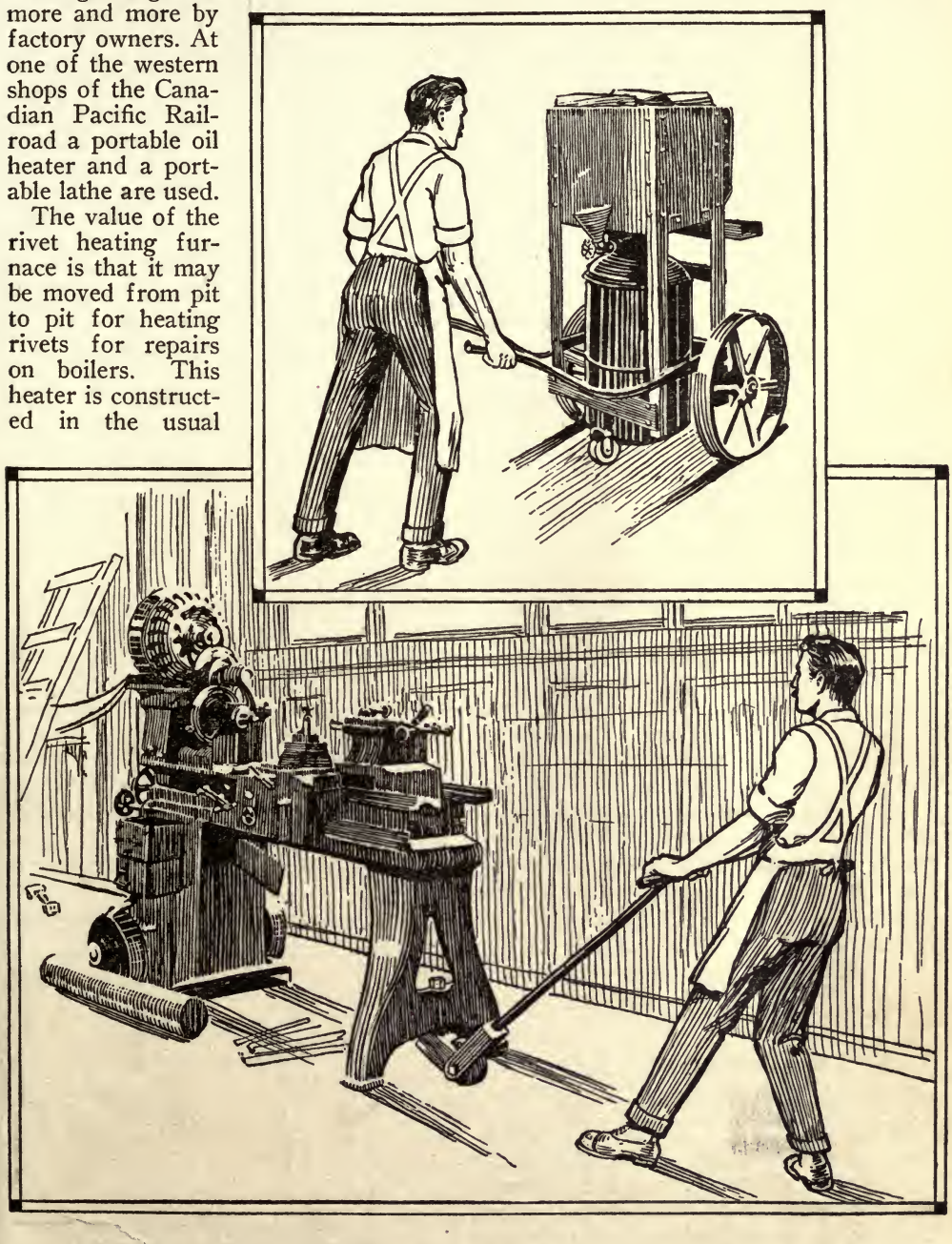
Portable Tools in Large Plants

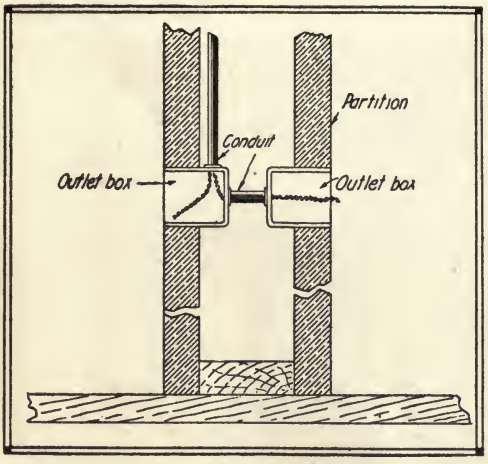
The convenience of portable tools and machines of every conceivable type is being recognized more and more by factory owners. At one of the western shops of the Canadian Pacific Railroad a portable oil heater and a portable lathe are used.

The value of the rivet heating furnace is that it may be moved from pit to pit for heating rivets for repairs on boilers. This heater is constructed in the usual way, with the oil reservoir below. It is carried from place to place in wheel barrow fashion, being provided with side handles and a small wheel in front.

The portable lathe when not in use rests upon three small wheels, so that it can be hurriedly pushed to a convenient spot in case of an emergency.

Contributed by P. W. BLAIR.





Economical Wiring for Bracket Outlets

In wiring a house by the "knob-and-tube," the conduit, or, in fact, by any method, considerable material and labor will be saved if the wireman locates the bracket outlets in adjoining rooms, so that the outlets will come directly opposite each other. Where the wiring is being installed in conduit, a short conduit nipple can be used to connect the two metal outlet boxes, and all bending, as well as the use of excessive lengths of conduit, will be avoided. Where knob and tube wiring is being put in, similar savings will be effected if the bracket outlets are intelligently located. Every bracket outlet ought to be located a distance of 5 feet 6 inches from the finished floor line, inasmuch as this is the standard height in residences in the United States.

Contributed by

ARTHUR GOODNOW.

To Prevent Poured Lead from Exploding

When melted lead is poured about a damp or wet joint, it "explodes," or scatters, due to the pressure of the steam suddenly generated. This trouble may be averted by melting a small piece of resin with the lead in the ladle, before it is poured.

Contributed by EDGAR JOHN.

Flux for Wire Soldering

Resin and wood alcohol make a good soldering flux for electrical work. An added advantage is that the joint will not corrode. To prepare the paste, the resin should be powdered and mixed into the alcohol until a moderately thick consistency is obtained. The paste should be applied freely to the surfaces to be soldered.

Contributed by

IRVING FARWELL.

A Safety Hint for Motorists

The possible danger of a "kick back" from an automobile engine when it is first cranked can be avoided if the crank is turned several times before the battery cells are switched on.

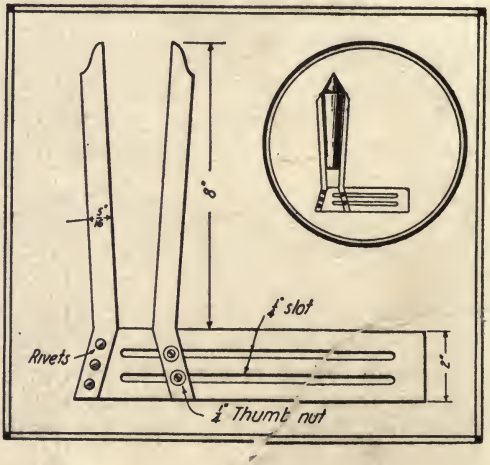
Contributed by

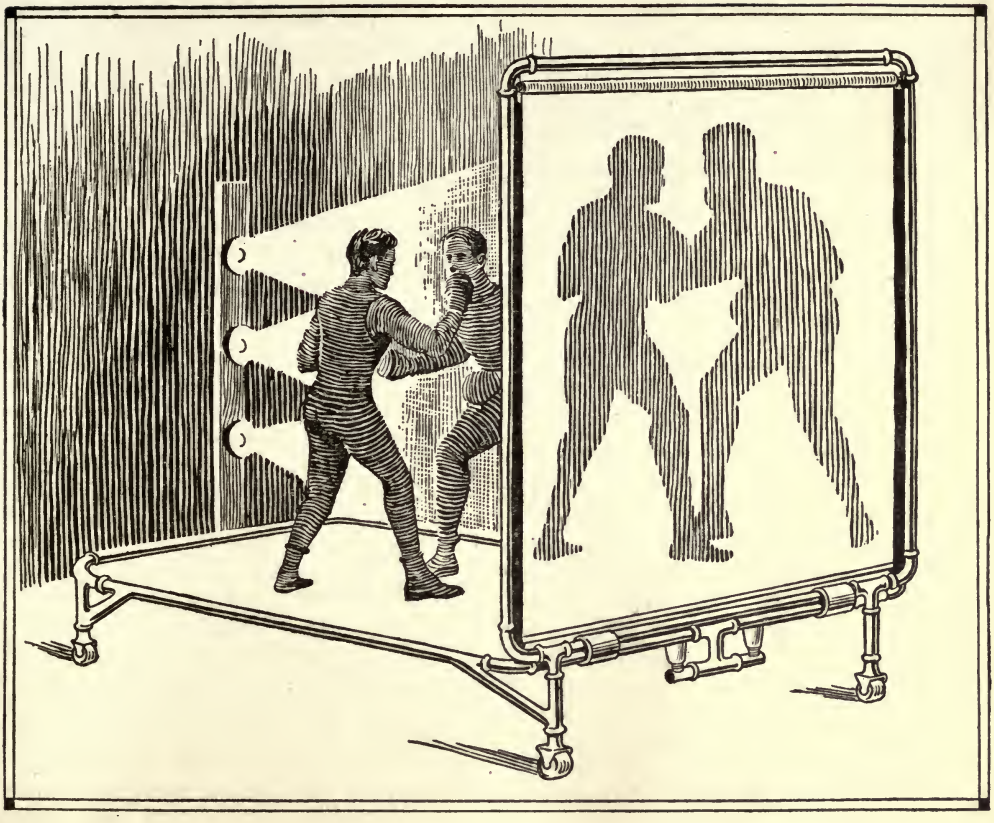
IRA MOSS.

An Ingenious Taper Gauge

Instead of using the ordinary taper gauge for fitting tapers, as is the common practice, a tool machined according to the accompany drawing may be used with much better results. Thumb nuts should be provided for the sliding bar, so that it may be adjusted without difficulty.

Contributed by JAS. MCINTYRE.





The "Spirit Shadow" Illusion

The effect of the spirit shadow illusion, as it is called, is secured by means of a darkened stage on which a brightly lighted platform on wheels is placed. The front end of the platform is covered with a curtain which works in a frame, the frame being set at right angles to the platform. Bright lights are at the back of the frame. The illusion is made possible by a trick of optics. The lighted curtain dazzles the audience. Between the curtain and the lights, figures perform various antics, and their silhouettes are thrown sharply on the screen.

Contributed by

HANDY MAN.

For Bending Wire

A simple wire-bending machine can be made by drilling holes into a plate of iron or steel and driving pins into them. These pins should be spaced according to the size of the wire. Should more than one turn be required, a number of such pins can be made, the length of succeeding pins being greater in order to allow the wire stock to be raised to clear the pins used for the bending operations following.

Contributed by

WM. HALK.

To Bend Tubes Without Kinking

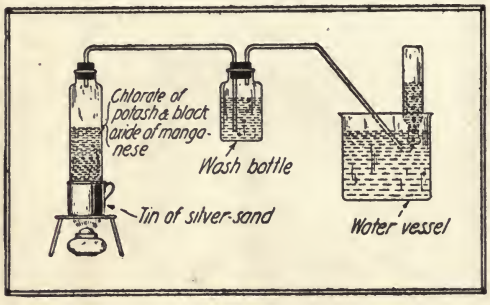
Tubes can be bent into any desired shape without kinking if the tube is previously filled with fine sand. After the bends are made, the sand can be easily poured out again.

Contributed by

EMERSON SMITH.

An Oxygen Generator

Oxygen generators are indispensable to the chemical laboratory. They can be made in a variety of forms, one of the simplest yet most reliable of which is



shown in the accompanying drawing. Its action is based on the fact that when a three-to-one mixture of chlorate of potash and black oxide of manganese is heated, free oxygen is given off. The chemicals should be heated very slightly. The best way to accomplish this is to rest the bottle in a tin cup partly filled with silver sand under which the flame is placed. A glass tube should lead from a rubber cork in the generator bottle into a wash bottle filled with water. The gas is thoroughly cleaned here and flows through a glass tube which terminates in a water vessel, where the gas is collected in bottles, as indicated. The corks should be sealed with shellac to prevent leakage.

Contributed by

H. A. McIlvaine.

Makeshift Ruby Lamp For Traveling Photographers

An emergency ruby lamp for the amateur photographer whose developing kit lacks a standard dark lamp can be made by tying a piece of red paper over the bulb of a pocket flash light. Extreme care should be taken in selecting the paper which is to be used. A better plan, probably, than the foregoing is to carry a small ruby bulb which can be substituted for the regular bulb of the flash lamp.

Contributed by T. N. Slocum.

Chewing Gum a Puncture Remedy

In an emergency a puncture in a bicycle tire can be repaired by chewing gum forced into the hole and held in place by a handkerchief bound tightly around the tire.

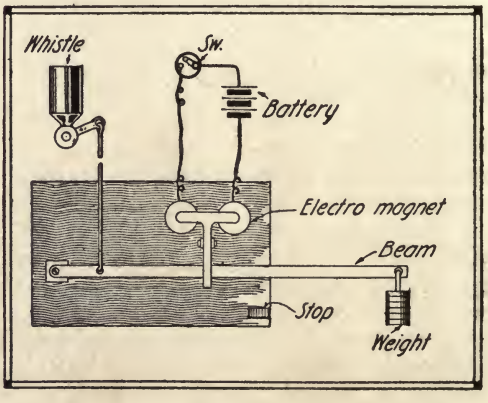
Contributed by

Donald Olson, Jr.

Pulls Whistle Electrically

In water power or electric lighting plants in small towns, where expense prohibits the installation of the usual electric fire whistle, an attachment can be fitted to the plant whistle, which will serve the purpose practically as well as the costlier made-to-order installation.

A heavy board should be nailed to some support below the whistle. A long metal beam, weighted at one end and pivoted at the other to a small pedestal, should be attached by a wire or stout cord to the whistle valve. A pair of electromagnets should be mounted on the board, and a pivoted release bar placed below them so that a broad flare at the upper end of the bar will come within a fraction of an inch of the cores. The flare acts as an armature. When current is sent through the coils of the magnets



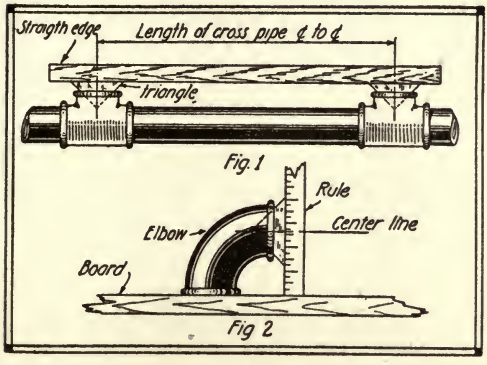
the armature is drawn down, a catch at its lower end releases the weighted beam, and the whistle blows until the beam is put back in place.

A small block of wood should be nailed at the lower corner of the board to act as a stop.

Contributed by Frank Sahlman.

Locates Centers of Pipes and Fittings

To locate the centers of pipes, elbows and other fittings, a wood tool can be used which will give accurate results. A triangle should be cut from 3/8-inch board, and glued tightly to a pocket rule. If an elbow is to be centered, it should be placed upon a smooth surface, and the triangle inserted. The exact center line will be found by consulting the ruler. The distance between centers of two pipes disposed in parallel can be



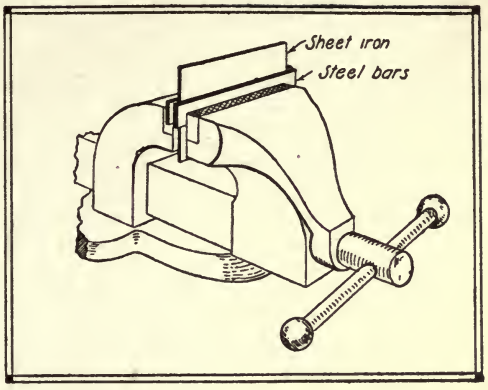
found by using two of these triangles and measuring the distance between their center points.

Contributed by
ARTHUR L. KREBAUGH.

Novel Tubes for Loose Couplers

If the paper or cardboard which is used in making loose coupler tubes for wireless receiving sets is soaked in flour paste, a much stiffer tube can be made than by the ordinary methods. Heavy paper is preferable to cardboard.

Contributed by G. L. PETTYCREW.



To Saw Thin Metal Strips

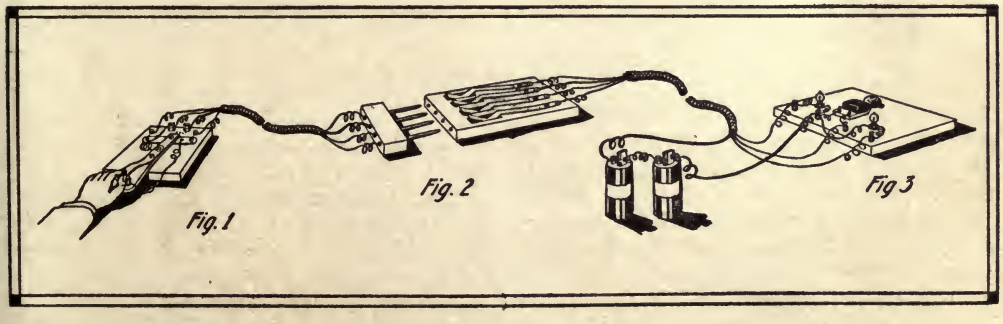
The uneven, ragged edge which usually results in an attempt to saw thin metal strips can be prevented if the stock is clamped tightly in a vise between two parallel steel bars. The cut should be made with the hack saw guided by the smooth surfaces of the bars.

Contributed by
C. P. CLEARY.

Electric Signals for Directing Tractors

Nearly all road graders are drawn by traction engines, and considerable difficulty is encountered in conveying the "stop," "go ahead," "go to right" and "go to left" signals from the grader to the man driving the traction engine. This difficulty may be overcome by the use of an electrical signaling system, which is quite easy to construct and is certain in its results.

The signaling apparatus should be attached to the engine so that it is in full view of the engineer. Two miniature electric lamps and a door bell will be re-



quired. The lights and bell should be fastened to a wood base which is bolted to the engine frame. The connections for the bell and lights, together with the necessary dry cells, are shown in one of the accompanying drawings.

The switches are to be screwed to a board which is installed in a convenient place on the grader. They should be constructed in such a way that easy and quick manipulation is possible. Fig. 1 illustrates the switch. The handle can be turned from hard wood stock and when finished should have a length of about 8 inches. Various adjustments of the switch will cause different contacts to be closed which will result in the bell or one of the lights giving a signal.

Fig. 2 illustrates the connecting plug, which should be bolted to the frame of the tractor. It comprises a long, flat, wooden block, bored out lengthwise with four small holes into which four spurs attached to another block will fit. Brass springs should be screwed upon the face of the large block and bent to fit into holes so that they will come in contact with the four spurs.

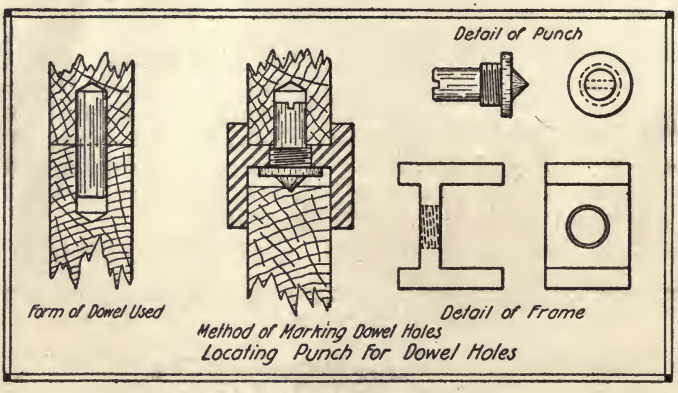
In signaling, the operator on the grader throws the switch either to right or left, according to which direction he desires the tractor to turn. The switch is depressed when he wants the tractor to stop.

Contributed by

J. C. LUNDHOLM.

Punch for Locating Dowel Holes

The task of locating with the necessary degree of accuracy a pair of dowel holes in wood is frequently a difficult one. The little device shown in the illustration will materially aid the workman in performing the task, and, considering the ease with which the tool may be made, it should find a place on every workbench where woodworking is done.



The punch is made up of two pieces, *i. e.*, the punch proper and the frame or holder. This is desirable because the construction is economical and it makes the device interchangeable. The punch can be removed from the frame and another inserted in the event that a hole of a different size is desired. The reader will note that the upper end of the punch is fitted with a slot in order that it may be quickly removed or replaced with an ordinary screw driver.

The device is invaluable for marking off dowel holes in the edges of boards used for table tops and in other places where it is essential that accurate work be done. By fitting a set of these punches to a board that has been drilled for the dowels, and bringing up the adjacent board, all of the holes in the second board can be marked off together and in exactly the correct relation to each other. There are other uses to which this suggestion may be put.

Contributed by

JOHN LEAFSTROM.

To Remove Scratches from Hard Rubber

Shallow scratches or engraving can be obliterated from the surface of India rubber by passing a heated soldering copper over a thickness of paper which is superposed upon the surface of the rubber.

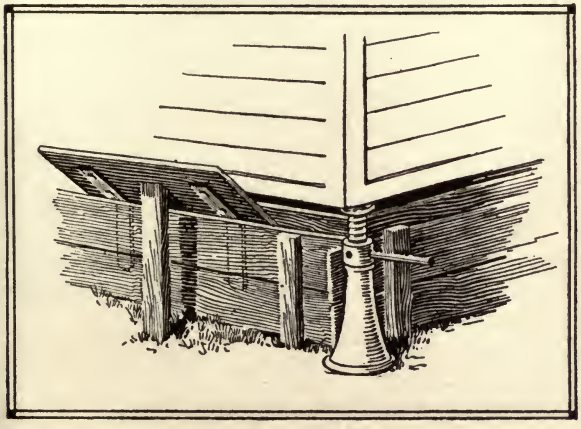
Contributed by

P. J. HOFFMAN.

Filling Foundation Trenches

When building foundations it is sometimes difficult to reach the forms after they have been put in place, in order to pour in the concrete. The problem can be solved by an arrangement similar to that shown in the illustration, which can be erected with materials usually available about the house, and without the use of special tools.

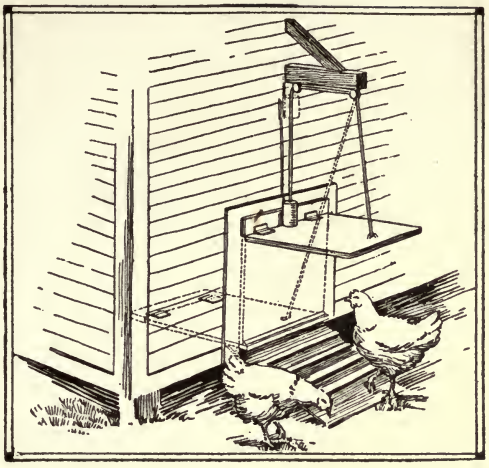
A simple plan is to bolt two pieces of iron strip on a board and slip their lower ends into the form where they are bent back, so that the board slopes outwards at an angle of about 45 degrees. A piece of wood or other material fastened to the middle of the board on the outside has its free end on the ground, thus holding the board in the proper position.



The concrete poured on this board will slide down into the form without the least trouble.

Contributed by

MARGARET W. MOODY.



Automatic Door for Chicken Coop

To obviate the unpleasant necessity of arising too early to open the door of the chicken coop and let the poultry into the yard, an automatically opening door can be easily made according to the design suggested in the accompanying sketch.

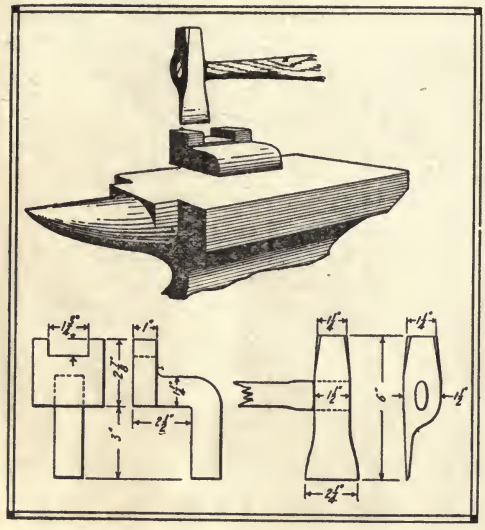
The first step in the work is to provide a hinged platform inside the chicken coop under which is placed a spiral spring of just enough strength to give away under the weight of a hen. A door is next made and hinged at the top as shown. To this door is fastened a rope leading to a weight that is heavy enough to lift the door. A small strip of wood is nailed across the front of the hinged platform, completing the work. The details are clearly shown in the sketch and require no further explanation.

The action of the automatic door is quite simple. As a hen steps on the platform the strip at the front end is pressed downward, releasing the door, which flies open because of the weight attached to it.

Contributed by

E. I. BRADSHAW.

Have you any ideas for this department? Why not send them in? Ideas are paid for at space rates when published in these columns.



An Ingenious Chisel Cutter

In the accompanying drawing the dimensions are given for the construction of a chisel cutter that can be used in dressing chisels, chisel bars, etc., by squaring off the ends. This tool comes under the "safety first" classification, as provision is made in the design to prevent the chipped portions from flying in the direction of the workman.

Contributed by

JOSEPH K. LONG.

Dollar-Saving Hint for the Woodworker

A handy device for use in cutting boards to given lengths is suggested herewith; in one instance alone its use has resulted in a saving of hundreds of dollars in the course of a year.

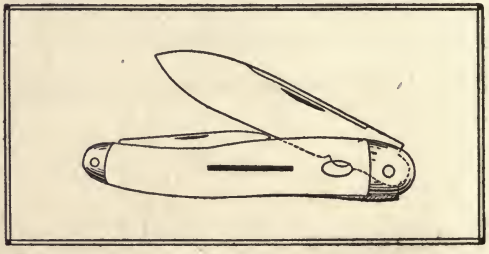
Referring to the drawing: The board *D* is placed upon the movable table, the stop *A*, which turns upon a pivot, is pushed up out of the way, and the end of the board is forced against the stop *B*, which is clamped to the guide *C*. The end of the board is trimmed, after which its position is reversed and the newly cut end placed against the stop *A* which has been dropped back in place. The unfinished end can then be sawed. The distance of the clamp on the guide *C* from the saw can, of course, be varied to accommodate boards of various lengths.

Contributed by

V. P. RUMELY.

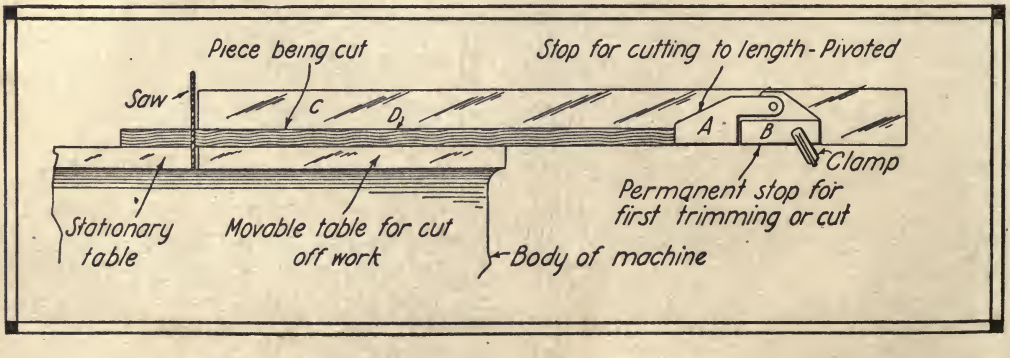
To Remove Rusty Pen From Holder

Rusty pens can be extracted from penholders by pen knives if a slight alteration is made to them. A 3/16" hole



should be drilled through the handle of the knife and filed to an oval shape. The portion of the edge of the knife which covers the hole should be filed to fit the concaved surface of the pen.

Contributed by MICHAEL JOHNSON.

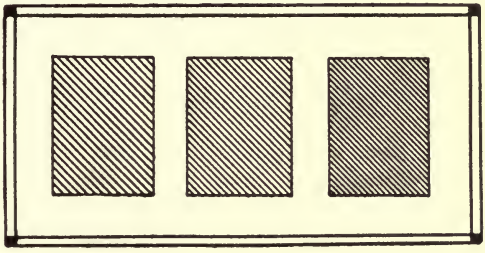


A SERVICEABLE SECTION LINER

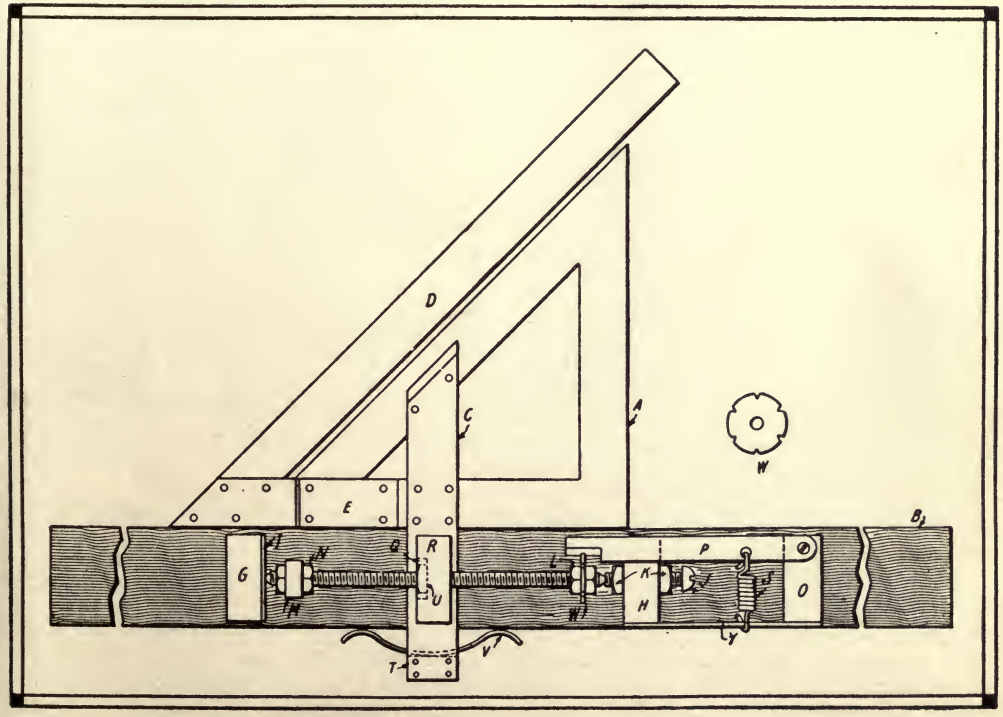
By C. H. Patterson

A section liner with which cross lines may be drawn with absolute accuracy is shown in the accompanying drawing. By means of a rachet, the consecutive lines will be drawn exactly the same distance apart. This distance may be varied easily.

The base of the section-liner consists of a strip of hard wood, *B*, which is pinned to the drawing board so that an angle may be obtained. The straight edge, *D*, is secured at its lower end to a 45-degree triangle, *A*, by means of brass plates, *E*. The triangle, in turn, is nailed to an upright strip of wood, *C*, to which the spacing mechanism is attached. At the lower end of this strip, a spring, *V*, is attached which provides rigidity in the straight edge, as well as smooth working qualities. The spring is held in place by a brass cap, *T*. A threaded wooden block, *R*, is nailed or glued to the upright strip and countersunk to accommodate a square nut, *R*, which is held securely in place by metal strips, *Q*. At right angles to the upright strip and through the block *R* a threaded metal rod, tapered at the ends, is passed. At one end of this rod, the rachet is placed. This consists of a metal plate, *Y*, soldered to the ends of brass blocks, *HO*, which are nailed to the base, *B;* and a spring, *S*, which



exerts a downward pull on the arm, *P;* the arm *P*, sharpened at the outer edge drops into the wedges of a brass adjusting knob *W*. The threaded rachet rod turns in a bearing consisting of an iron



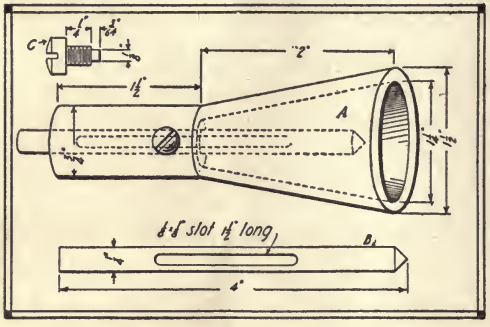
screw, *J*, which passes through the block *H*, and is held in position by the nuts, *K*. The rachet, *W*, is held in place by the hexagonal nuts, *L*.

The opposite end of the rachet rod revolves in a bearing *GI*. An adjusting knob, *M*, of rubber or brass, is held in place by hexagonal nuts, *N*.

In operation, the base, *B*, is pinned to the drawing board at whatever angle is desired. A line is drawn across the straight edge, *D*, the knob, *M*, is turned until the rachet clicks, when the rule will have been moved far enough to the right for another line to be drawn. If a wider space between the line is desired than a single action of the rachet wheel provides, the knob may be turned until the spring clicks twice, or three times. Care must be taken then, of course, that the number of rachet spacings is borne in mind at the beginning of each line.

Centering Tool

An idea which will be found useful by mechanics for centering rough stock



is shown in the accompanying sketch. The tool should be fashioned from tool steel or cold rolled steel, case hardened. A rod, 3⅝ inches long and 1½ inches in diameter, should be adjusted in the lathe chuck until it runs true. After centering, a 15/64-inch hole should be drilled entirely through and reamed out with a ¼-inch reamer, after which the front end of the piece should be cut out, as shown, until the large opening measures 1¼ inches across. This should be smoothed carefully. The opposite end should then be cut to a diameter of ¾ inch and a 3/16-inch hole drilled, tapped and countersunk.

The plunger, *B*, should be made from hard steel, machined to a point at one end so that a 30 degree angle is formed, and a slot, ⅛-inch x 1½ inch, milled in the center. The slot prevents the plunger from sliding out after the 3/16-inch screw is set in its proper place.

The screw, *C*, should be turned in the lathe at the threaded end so that it will fit in the slot of the plunger.

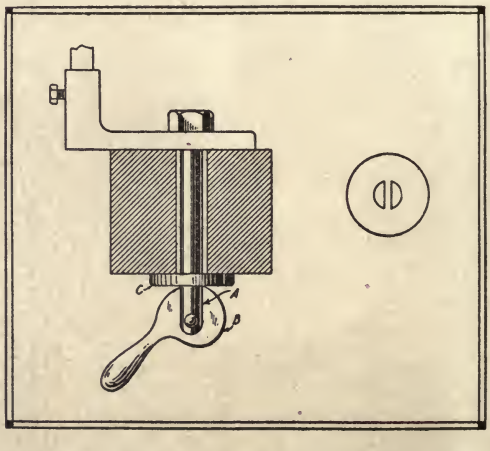
In use, the tool is fitted over the end of the stock to be centered, and a sharp blow struck with a hammer on the protruding end of the plunger.

Contributed by

JAMES MCINTYRE.

Handy Lock for Lathe Rest

A quick-acting lock for a wood-lathe rest is illustrated in the accompanying drawing. The rod, *A*, should have a diameter of approximately ¾ inch, and



have a slot at one end to admit the cam, *B*. The washer, *C*, should be cut at the center to fit loosely over the slotted bolt.

Contributed by M. A. PIPER.

A Modern Reminder

Instead of knotting a string about the finger to prevent the forgetting of an important duty, several initials may be written in ink on the face of a watch. Each time the watch is consulted, the memory is stimulated sufficiently by the initials so that the particular duty will not be easily forgotten.

Contributed by

E. A. HODGSON.

To Pour Acid Safely from Carboys

The danger involved in pouring sul-

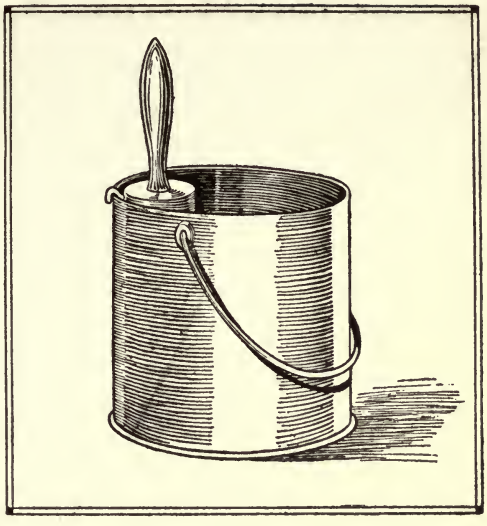
phuric acid from a carboy can be avoided if a bent glass tube is inserted into the neck of the bottle so that the partial vacuum caused by the liquid gushing out is equalized.

Contributed by

GEO. S. SCHOONOVER.

A Brush Holder

It is often necessary to lay aside a brush during a painting job and if it is placed in the can there is a possibility of its becoming entirely covered with paint, which is obviously unpleasant. In order to eliminate this trouble, a screw hook or bent nail can be placed in the



handle of a brush, as shown in the sketch. Thus, when the brush is not required for the moment, it may be placed in the can without danger of its becoming entirely covered with paint.

Contributed by

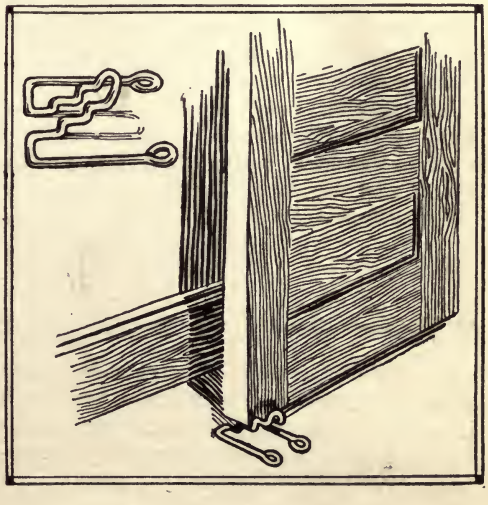
GLENN G. FOGLESONG.

Bent Spring Holds Door Ajar

A handy catch for the door, which will prevent its being blown shut when ajar, can be made from stiff brass or steel wire of 10 or 12 gauge.

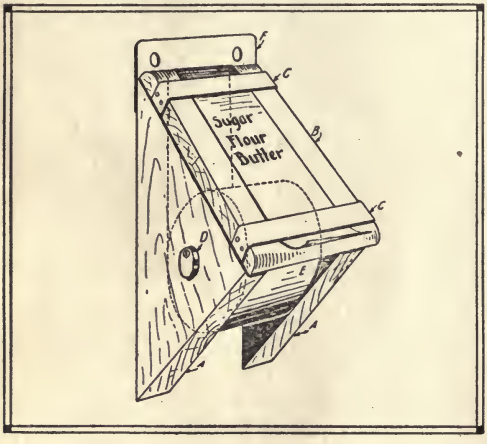
Contributed by

EMERSON SMITH.



Memoranda Holder for the Housewife

A very handy kitchen memoranda-holder for the busy housewife, on which she may jot down articles to be ordered, is illustrated in the accompanying drawing. It requires but three pieces of board, three pieces of tin and a piece of



wooden or metal rod to hold a roll of paper, such as is used in adding machines, or any other roll of paper that may be obtainable—the roll determining the size of the parts for the holder.

The two side pieces, *A*, are sawed out alike from 5/8-inch or 3/4-inch stock, clamped together and the holes for the roll shaft bored. Then the top piece, *B*, with tin strips, *C*, attached, is fastened to them. Wood or metal discs, *D*, with a screw-hole off center, should be used to cover the shaft holes so that shaft will stay in place, yet may be swung aside to remove shaft in renewing rolls, *E*.

The holder may be attached to the wall by the tin piece, *F*, which is fastened to the back, and a pencil hung close by on a string to be always at hand.

Contributed by

ARTHUR A. HORN.

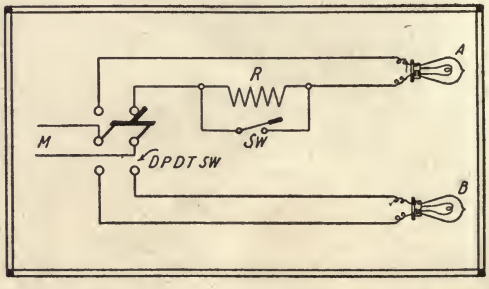
Temporary Repair for Gasoline Cock

If the drain cock of a gasoline tank on an automobile is in a leaky condition it can be temporarily repaired by removing the plug key and smoothly wrapping several thicknesses of thin tinfoil around it. The plug should be pushed in tightly and the washer, spring and cap-screw replaced.

Contributed by JOHN HOECK.

Correct Lighting for the Dark Room

The proper illumination of a photographic dark room should consist of three lights, one of which is white, another bright red and the third dim red. These results can be obtained if two 16 c.p. lamps, one of clear glass, or frosted, and the other red, are used. A small resistance, *R*, composed of a length of German silver wire wound upon an asbestos core, should be inserted in the circuit in which the red lamp, *A*, is connected. A single-throw single-pole knife switch, *SW*, should be shunted across this resistance coil so that the intensity of the light can be quickly changed from brightness to dimness. Current from *M* flows through the double throw double pole knife switch, which is indicated as *DP DT SW* in the drawing, into either



the red lamp circuit or the white lamp circuit, as desired.

Contributed by

J. QUINCY HOLMES.

A Lubricant Chart for the Machine Shop

Various types of machinery require different grades of oil for their correct lubrication. This important fact is often disregarded in many of the most up-to-date machine shops. A chart of lubricants, which has been carefully worked out from experiments covering a long period, appears on the facing page. If

Type of Machine Tool	MACHINE PARTS					
	Plain Bearings	Ball Bearings	Gears	Driving Chains	Slide & Guides	Vertical Bearings
Engine Lathe	B	Petrolatum	Petrolatum	A	Engine Oil	B
Turret Lathe	B	C	V	A	Engine Oil	B
Shaper	Machine Oil	Petrolatum	Petrolatum	A	Engine Oil	B
Milling Machine	Machine Oil	Petrolatum	Petrolatum	A	Engine Oil	B
Planer	Machine Oil	Petrolatum	Petrolatum	A	Engine Oil	B
Screw Machine	B	C	V	A	Machine Oil	B
Threading Machine	Machine Oil	Petrolatum	Petrolatum	A	Machine Oil	B
Drill Press	Machine Oil	C	Petrolatum	A	Machine Oil	Engine Oil, Machine Oil
Tapping Machine	B	C	V	A	Machine Oil	B
Grinder	B	C	V	A	Engine Oil	B
Punch Press	Engine Oil	Petrolatum	Petrolatum	A	Engine Oil	Engine Oil
Broaching Machine	Machine Oil	Petrolatum	Petrolatum	A	Engine Oil	Engine Oil

A	10 parts tallow, 2 parts cylinder oil, 1 part powdered graphite, mix while hot.
B	1 part lard oil, 1 part machine oil, 2 parts paraffine oil.
C	Petroleum jelly thinned with paraffine oil.
V	Viscous mineral oil
S	5 lbs. sal soda, 41 gallons water, 3 gallons lard oil, 15 lbs. soft soap. Mix by boiling 1 hour.
T	½ lb. flour of sulphor to 1 gallon of lard oil.
O	2 parts lard oil, 1 part mineral machine oil, 1 part paraffine oil.
P	Paraffine oil

Operation	MATERIAL											
	Cast Iron	Tool Steel	Mild Steel & Wrought Iron	Yellow Brass	Red Brass Bronze	Copper	Aluminum	Zinc, Nickel, Tin.	Babbit Bearing Metals	Die Casting	Wood Bakelite Condensite Fiber	Hard Rubber Guttapercha
Drilling	None	O	O. S.	None	None	O	Kerosene	None, P	None	None	None	None
Boring	None	O	O	None	None	O	None	None	None	None	None	None
Reaming	None	O	Lard Oil	None	O	O	Kerosene	P	Kerosene	None	None	None
Tapping	O. S.	O	O	O	O	O	Kerosene	P	Kerosene	Kerosene	None	None
Turning	None	None	None S	None	None	None	None	None	None	None	None	None
Shaping	None	None	None	None	None	None	None	None	None	None	None	None
Planing	None	None	None	None	None	None	None	None	None	None	None	None
Cutting off	None	O, S	S	None, S	None S	None, S	None	P	None	None	None	None
Threading	O	Lard Oil	Lard Oil	Lard Oil	Lard Oil	O	Kerosene	P	Kerosene	Kerosene	None	None
Gear Hubbing	None	Lard Oil, S	T. S	Lard Oil, S	Lard Oil, S	Lard Oil, S	Kerosene	P	None	None	None	None
Milling	None	O	O. S	None. S	O, S	O	Kerosene	None	None	None	None	None

the suggestions offered are followed, burned bearings will be less frequent, and a considerably higher efficiency will result.

Regarding the tabulated lubricants, several important points should be borne in mind. The compound, *S*, is commonly known as soda water, and its composition can be varied to a certain extent. It should not, however, be allowed to become caustic, or it will injure any metal with which it comes in contact. Where lard oil is referred to, No. 1 pure raw lard oil is meant. The machine oil mentioned in the tables and in the oil compounds should be pure mineral oil—very fluid, rather viscous, and having a flash point of about 500 degrees F.

Contributed by

F. B. HAYS.

Porcelain Tube Sharpens Knife

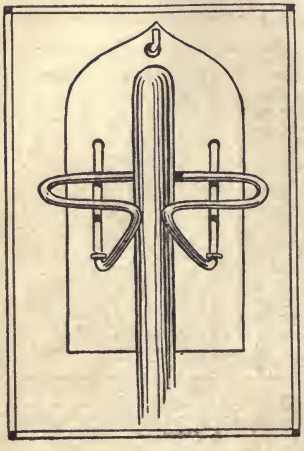
An unglazed porcelain tube or cleat makes a good whetstone for sharpening a jack-knife. Either of these can be secured at any electrical supply store at a cost of a few cents.

Contributed by

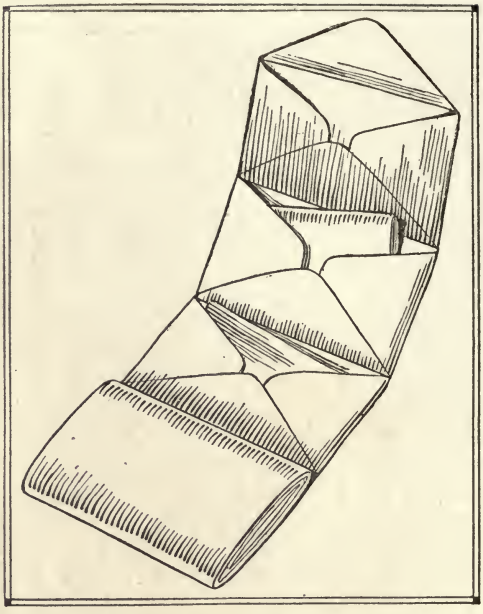
O. S. WADE.

Broom Holder Made from Spring Wire

A handy holder for brooms when not in use can be made from stiff spring wire bent to the shape shown in the accompanying drawing and fastened with brads to a small wood block which may be suspended from a screw-eye driven in the wall. The wood can be painted to match surroundings.



Contributed by H. DOLPH.



A Home Made Portfolio

A cheap portfolio can be made from four ordinary envelopes by gluing the flap of the first to the face of the second; the flap of the second to the face of the third, etc. Different sizes of envelopes can be used for various requirements.

Contributed by

WILLIAM OJA.

To Remove Tarnish from Copper

Tarnish may be removed from copper by simply rubbing the surface with a common ink eraser. The "grit" in the eraser removes the tarnish without scratching the metal.

Contributed by

WILLIAM A. CAWLEY.

Hints for Motorists

In nearly every case of a slipping clutch the difficulty can be overcome by the application of carbide ashes to the face of the clutch. If carbide ashes are not available, a good substitute is either tire mica or tire talc.

A useful starting crank holder can be made from an ordinary screen door spring and a harness ring. The ring

should be fastened to one end of the spring, the other end being attached to the car frame or lamp bracket. The crank handle is placed in the ring and allowed to drop to a natural position, where it will stay until used again. This arrangement affords a better means of holding a crank than the usual leather strap.

To avoid the trying experience of picking screws out of the drip pan by hand, an implement is suggested which may be constructed as follows: Break a piece about an inch long from an ordinary horseshoe magnet and fasten it to a rod 18 inches long. Iron screws which fall into the drip pan can be restored very easily with the aid of this magnet.

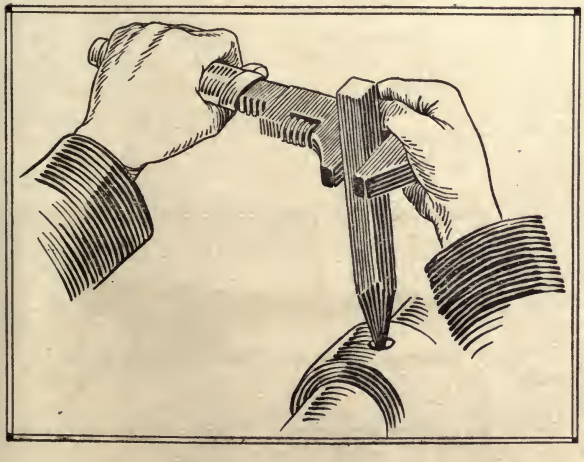
Contributed by

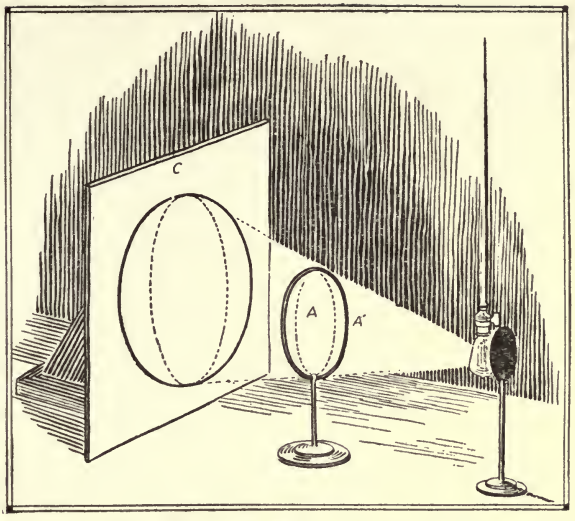
F. P. DICKOVER.

To Remove a Broken Machine Screw

A broken set screw can be removed with a small square chisel which has been sharpened to a point at one end. A small hole should be drilled a short distance into the broken screw, the chisel point inserted and the blunt end struck a sharp blow with a hammer. By means of a wrench clamped to the chisel the screw may be turned and removed with little difficulty.

Contributed by E. E. DICKSON.





Drawing an Elipse with a Shadow

A perfect elipse can be drawn on paper by mounting an iron ring on a stand between an electric lamp and a vertical drawing board. A shadow will be cast on the board from the ring, and will assume various forms of elipses as the ring is turned. The size of the elipse may be varied by moving the circle nearer to or farther from the lamp.

Contributed by JAS. MCINTYRE.

Acid Ink Eraser

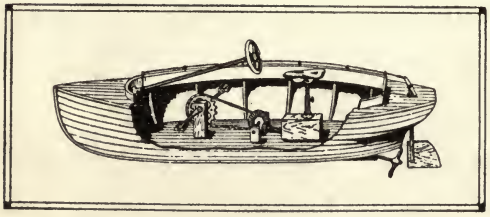
An attempt to erase ink with an ordinary ink eraser or a knife usually results in an unsightly blotch. Acid or chemical ink erasers have a decided advantage, although they are usually rather expensive. A good acid ink eraser, however, can be made quite cheaply.

Into a liter of distilled water dissolve 110 grams of chloride of lime and allow the solution to stand for 24 hours. Strain through a cotton cloth and add 10 parts of acetic acid to each 25 parts of solution.

Apply the eradicator with the reversed end of a pen holder and absorb the surplus with a blotter when the ink has entirely disappeared.

Contributed by

W. S. ZEHRUNG.



Boat Propelled by Foot Motor

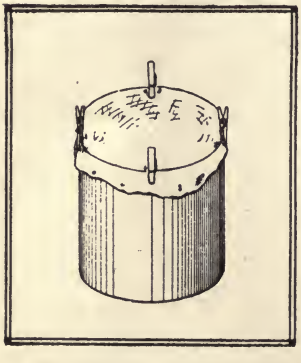
Although boats propelled by "man power," which is applied through any other form than oars and paddles, are not relatively efficient, they are a distinct novelty and afford a great deal of entertainment. The driving mechanism will depend entirely upon the resources of the constructor; ordinarily, discarded parts from old bicycles, a couple of second-hand cogs, and the shaft and propeller from a worn-out motorboat, will be sufficient. Pains must be taken in the design, so that the parts will co-relate with the general proportions of the anatomy of the man who is to do the work of propulsion.

Contributed by

CARL HANCOCK.

Holds Strainer Cloth in Position

An improvement over the old method of fastening the strainer cloth which is used for straining liquids by binding it along the edges with cord is suggested in the adjacent illustration. Small clothes pins will do the work equally as well and are easier to handle.



Contributed by

B. W. VERNE.

Ideas submitted for this department are paid for at space rates when published.

To Renew a File

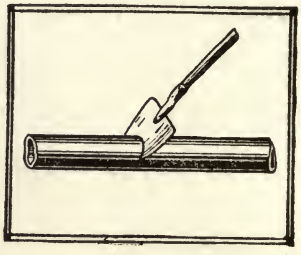
Old files can be renewed by a thorough cleaning with a fine wire brush, followed by a bath in dilute sulphuric acid.

Contributed by

JOSEPH MISKINIS.

A Pipe Scraper

A pipe which is covered with dirt or grease can be cleaned with an old spade which has been ground out to fit the diameter of the pipe. The method of using the spade is shown in the accompanying sketch.



Contributed by

B. W. VERNE.

A Labor Saver for the Washerwoman

The heavy task of emptying the water from a wooden washtub can be obviated by boring a small hole in the bottom of the tub near the edge and fitting it with a wooden plug.

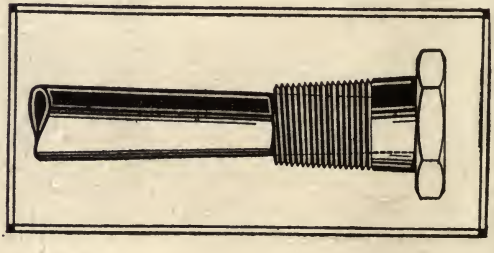
Contributed by

R. D. SOUTHERN.

Emergency Repair for Stuffing Nut

A worn packing nut can be repaired temporarily by driving a taper mandrel into the center, so that the threads of the nut will expand sufficiently to again fit tightly.

Contributed by J. N. BAGLEY.



A CRAFTSMAN SUMMER COTTAGE

Describing a Summer Dwelling that May Be Constructed by the Average Handy Man at Low Cost.*

By Ralph F. Windoes

Instructor of Manual Training, Davenport High School, Davenport, Ia.

Illustrations from drawings made by the author

LAY the flooring on the frame, as constructed from our previous instalment, at right angles to the joists. Select very straight pieces for the first boards layed, and nail through the tongue into each joist, using the 8d nails. The latter should slant toward the center of each piece so as to draw up boards that have a tendency to hold out. The pinch bar and a short piece of 2 by 4 will help very materially in pulling up obstinate members. Joints should be broken on joists only.

Cover the entire floor, porch, living room and kitchen so that there will be provided a level surface to frame the walls upon

Fig. 12 shows the construction of the framing at one corner, while Fig. 13 gives details of the front and rear wall frames of the living room.

Frame the front section first, nailing it together while it is laid out flat on the floor. Select two straight 2 by 4's for plates, as long as the floor is wide. If it has been built accurately according to dimension, these will be 23′ 6″, but to make sure it is safer to lay them out from the floor width.

From the 16-foot batch of 2 by 4's, cut twenty-six that are 14′ 4½″ long, for full length studding. Be very sure that you cut both ends *square*. Measure up from the lower ends 8′ 8¼″, and mark the *top* edge of the ledger board cut, then *back* 4 inches, as illustrated in Fig. 13. The ledger boards will be set in their full thickness, ⅞″, hence the constructor must cut this amount from each stud before it is nailed into place.

Select twelve of the studs for the front wall, and spike two pair of them together for the corners (see Fig. 12). Nail these in place through the plates. From the *center* of each plate measure over each way 24″ distances, and put in studs at these marks so that the center of each will coincide with the marks, as illustrated in Fig. 13. Leave spaces for the door and the window frames, which can be put in place temporarily and fitted around.

*This article is one of a series that has appeared in every issue of The World's Advance, beginning with the May number. The concluding instalment will appear in the August issue. Back numbers may be obtained at 15 cents each while the supply lasts.

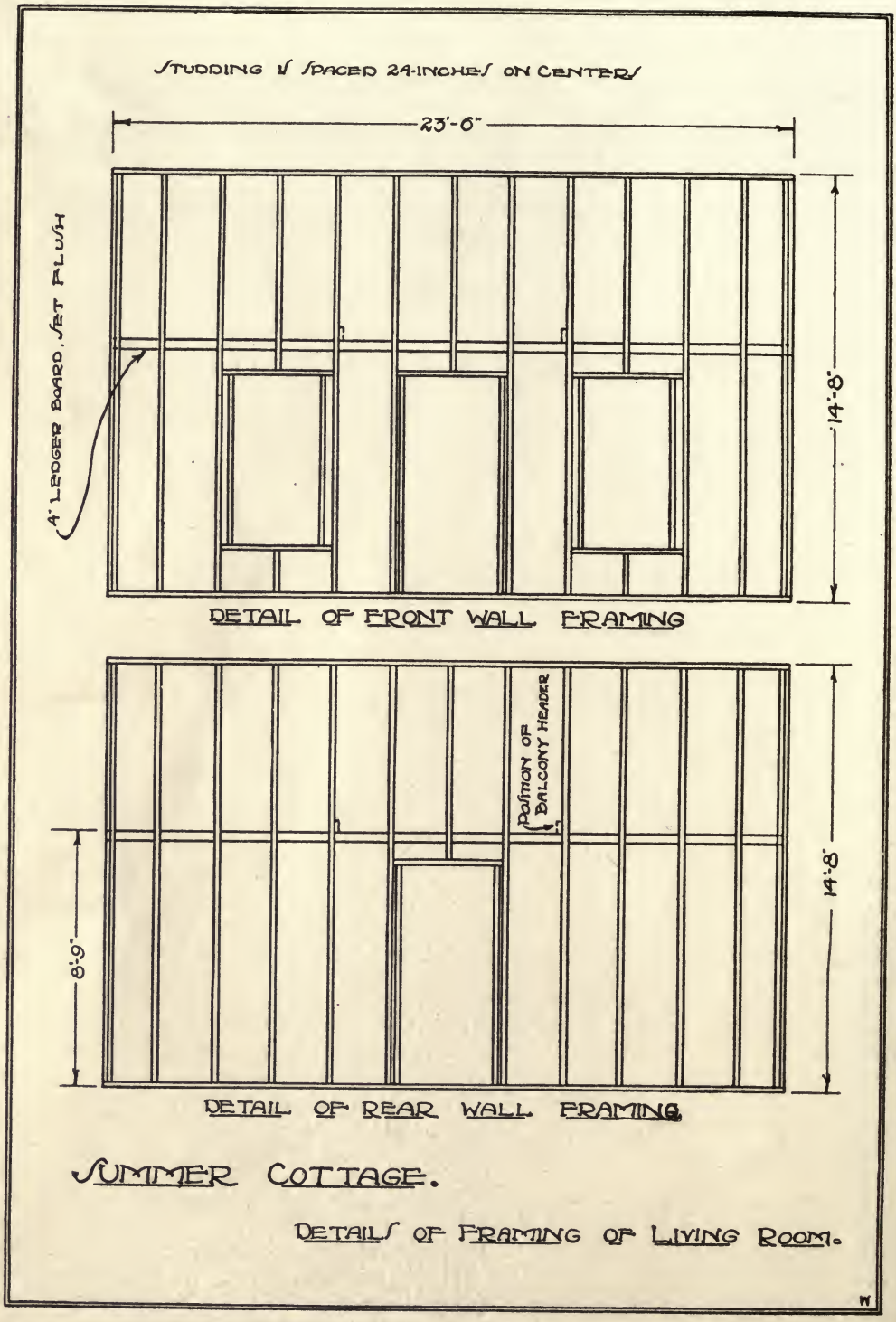


Fig. 13—Details of the Front and Rear Wall Frames of the Living Room.

Fit the door frame first, and nail the header across. Remember that when the frame is erected the floor plate crossing the door opening will be removed and the sill of the frame will drop to the floor — hence the header will be lowered a little on this account.

The top window headers will be on a level with the door header, and the bottom will be fitted from the window frames. Place the uprights in each opening, allowing about ½ inch clearance on each side of the frame. Put in the short length studs, and cut out the ledger board lap in them. The ledger can be ripped from a piece of flooring. The reader will understand that it is used to help stiffen the frame and as a support for the balcony headers.

Remove the door and window frames if you have not already done so, and raise the wall frame into position. It must be square with the wall line, and rest over the double joists in the floor

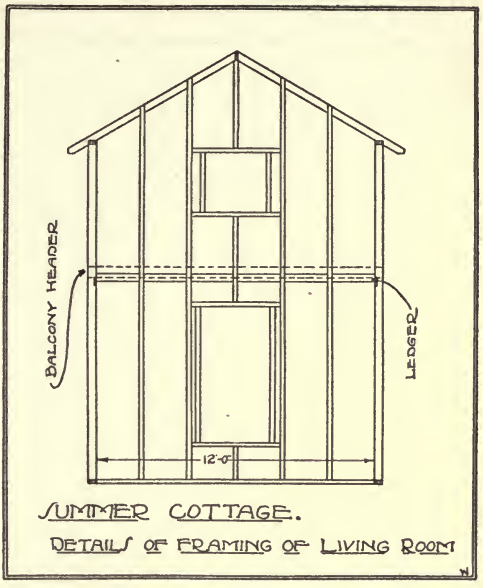


Fig. 15—Showing the Spiking and Bracing of the Rear Wall.

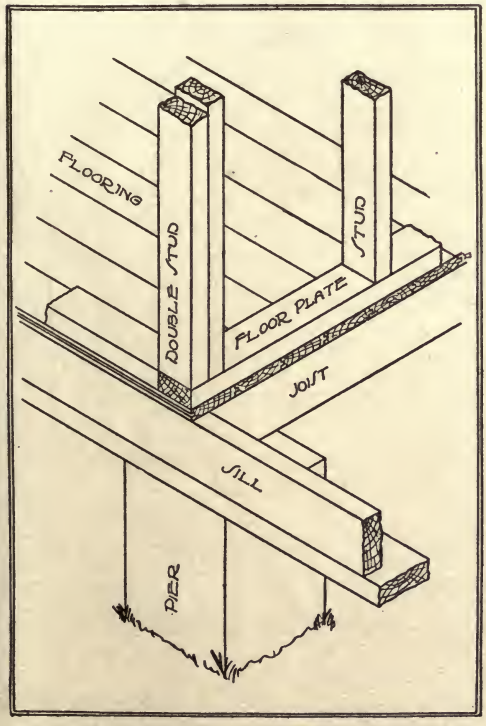


Fig. 12—Showing the Construction of the Framing at Floor.

frame. It must also be plumb. Spike it to the floor through the plate and stiffen it with diagonal braces, as suggested in Fig. 14.

Frame the rear wall in exactly the same manner and raise it into position. Spike and brace it firmly 12 feet from the front wall, as seen in Fig. 15. The best method of doing this is to cut the two side wall plates 12 feet long and nail them into position, after which the rear wall frame can be butted against their ends. When plumb, firmly brace it as you did before, and nail the balcony headers in place. They will help to hold the walls together.

Next frame the roof. This is one of the most difficult parts for the beginner, but we have endeavored to illustrate a method altogether shorn of technicalities. Although it is not exactly accurate, and would not pass as a good method for a master builder to use, it will do very well for the work at hand.

Select one straight 2 by 4 by 10 feet, and at the upper end, *a*, in Fig. 16, lay the steel square so that the 13½" mark on the blade just touches the outside edge at *b*, and the 7 13/16" mark on the

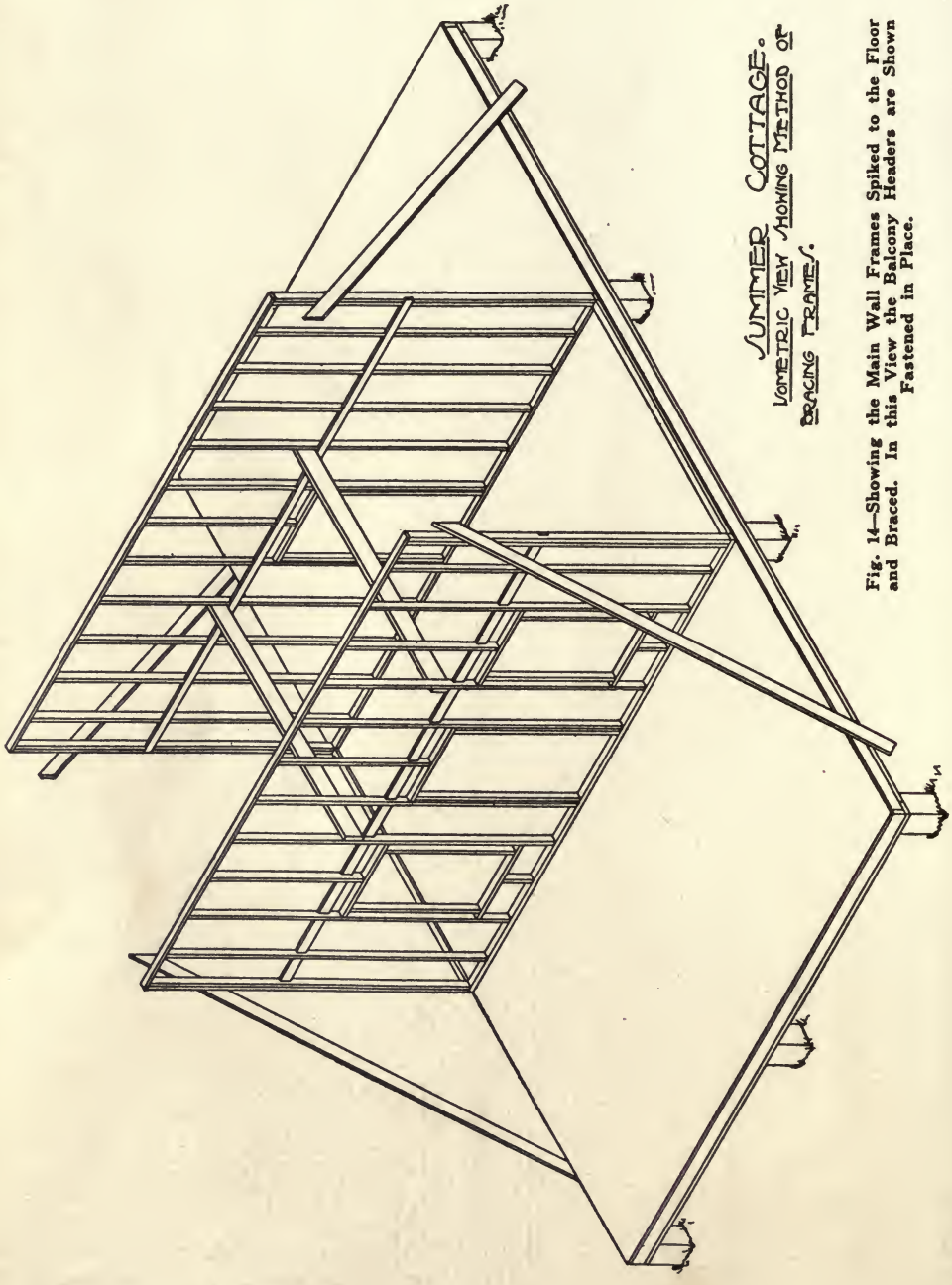


Fig. 14—Showing the Main Wall Frames Spiked to the Floor and Braced. In this View the Balcony Headers are Shown Fastened in Place.

tongue is exactly on the corner. Along *a-c* draw a line, and this will give you your plumb cut.

Now from *a* measure down 7′ 3″ to point *d*, and, in exactly the same way, using point *d* as you did *a*, strike *d-e*, which will be parallel with *a-c*. Then, in the position that we have it illustrated *d-e-f*, draw the horizontal line of the heel cut. When finished, the heel cut should have its dimensions as detailed. The lookout, from *d* to the end cut, is 12 inches.

Saw these cuts exactly square with the edge, and lay out another rafter in the same manner. Nailing a small block, which is substituted from the ridge board, on the plumb cut of one piece, put these rafters into position on the plates. If the work has been accurately done, and the plates are just 12 feet apart, the heel cuts will come exactly right and square with the plates. If not, then you must cut and fit the rafters until they are satisfactory. When accurately fitted, use the best one as a pattern, and cut twenty-four more exactly like it. Select a piece of straight flooring that is two feet longer than the width of your cottage, and nail the rafters in place, as illustrated in Fig. 17.

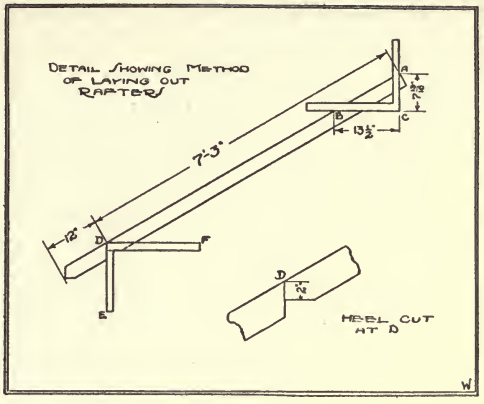


Fig. 16—Showing the Method of Laying Out the Rafters.

They are also spaced 24″ on centers, and should be accurately layed out on both sides of the ridge and on the plates.

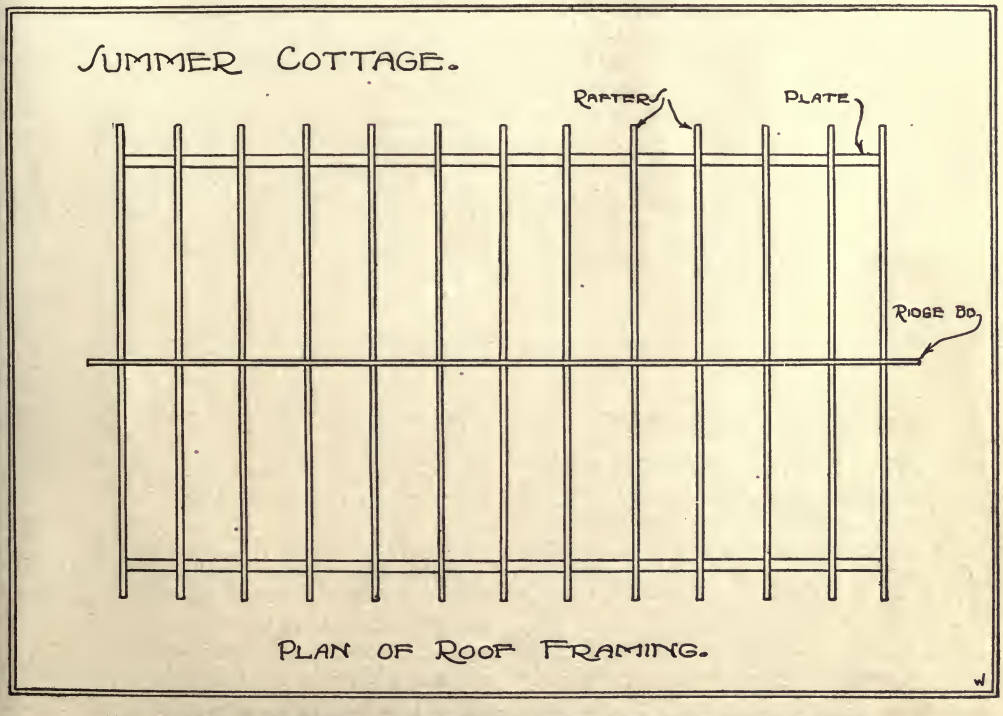


Fig. 17—Plan of the Rafters as they Should Appear After Being Nailed in Place.

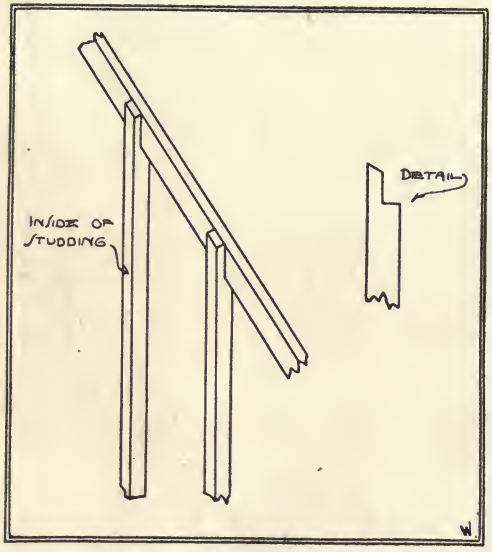


Fig. 18—Detail of Upper End of Studding at Gable.

Next, fit the end studding in between the floor plates and the end rafters, as seen in Fig. 15. Fig. 18 gives a detail of the upper end which is cut around the rafters on the outside. They are spaced 24″ on centers, and have a ledger board whose top edge comes two inches above the ledger boards on the front and rear walls. This is necessary because the headers are 2 by 6's, and the joists but 2 by 4's, and their top edges must be level.

Rip a 2 by 4 and nail one-half of it on the inner edge of each header, as pictured in Fig. 19, and place the balcony joists into position. Of course, they are spiked to the studding at their outside ends. If the builder desires he may at this time place the flooring upon them, and put in the 1½″ pipe support under the center of the headers, as is also seen in Fig. 19. This will provide two strong platforms upon which he may work while fitting the roof boards and the siding.

In following the detailed instructions and sketches, the reader should be very careful and refer constantly to the floor plans and elevations given in the May instalment of the series, in order to check up the various dimensions.

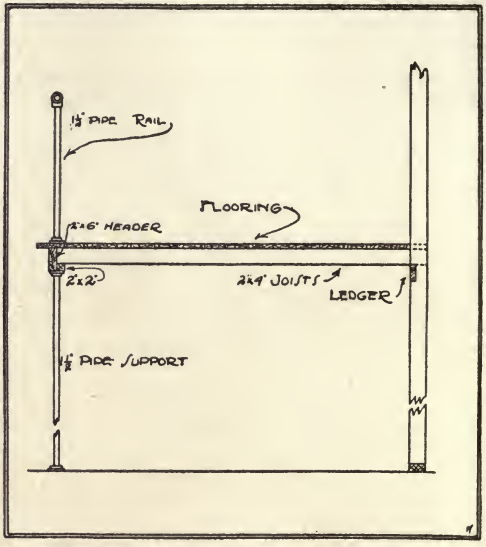
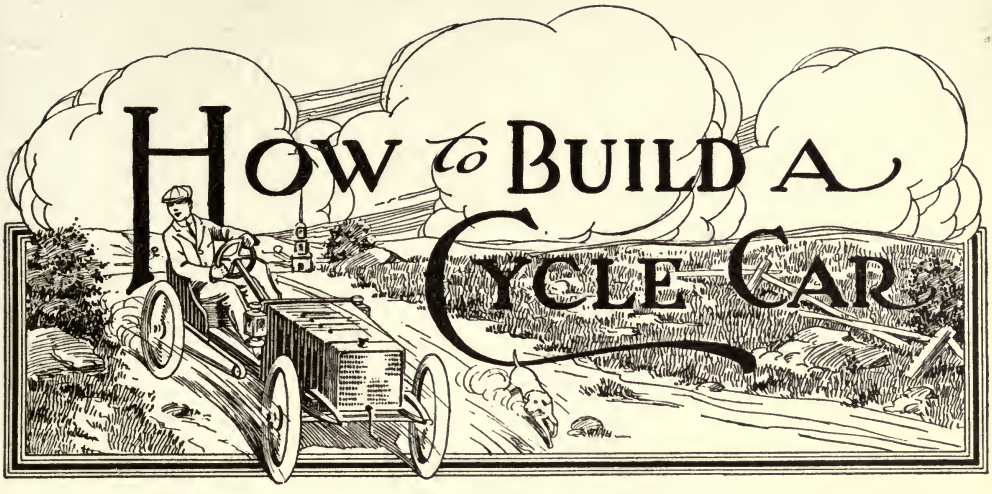


Fig. 19—Detail of Balcony Construction.

AN IMPROVED BRAKE

There has recently been tested an improved brake system that actually stopped a train of twelve steel passenger cars and a locomotive, weighing in all nearly a thousand tons, within a thousand feet, or the length of the train, when running at a speed of sixty miles an hour. The energy generated by a train of that weight running at that speed corresponds to that of a blast of dynamite powerful enough to blow the entire train 120 feet into the air. The high-speed brakes now in general use would in an emergency stop the same train within a distance of from 1,600 to 1,800 feet.

American manufacturers of electrical devices would do well to consider carefully Siberia as a possible field for their wares. In that country the development of electricity is now taking place, and there is an increasing field for electrical devices.



How to Build a Cycle Car

WHILE this article is intended primarily as a series of suggestions to the amateur mechanic who contemplates building a cycle car, still the design has been worked out down to minute details as a glance at the drawings will show. Therefore, by closely following the specifications the builder may feel reasonably certain that his finished product will equal the car shown in the illustrations.

SIMPLICITY has been the aim throughout in the planning of the little car* to be described, for it is realized that special forgings and even castings of intricate parts, while not actually beyond the amateur mechanic, are still formidable to contemplate, and, as our car is to be strictly a home product, with the possible exception of engine and wheels, every effort has been made to incorporate only those fittings which might be easily obtained. It is fully realized that the design has many shortcomings and the builder who is capable of better things will certainly not use a wrought iron pipe tee when he can just as well employ a forging. To such a builder, the author merely offers the design as a broad, general suggestion in the hope that it may prove of some assistance in the working out of something better.

The tools actually required for the construction of our car are comparatively few and simple. The possession of a lathe is a fortunate one, but the amateur who has access to a near-by machine shop need not hesitate to undertake the work, even though he has no lathe of his own. The machine work on the car is very simple and therefore inexpensive, even if done on a time basis in a shop. The principal requisites are a fairly good set of carpenters' tools, a pipe vise and cutter, as well as a set of pipe dies, an assortment of metal drills, a substantial breast drill with chain for tension, a hack saw, files, wrenches, etc. The pipe fitting tools may even be dispensed with if the machine shop is close

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at hand, for all the threading can be done better in the enginee lathe.

The workshop should preferably be spacious; a barn or carriage house is excellent. It is very likely, however, that the place to be used for the final housing of the car will have to answer the purpose. While the author may be accused of using chestnuts, still, it seems advisable to repeat the time-worn story of the chap who built his boat in the cellar and then had to tear out the side of the house in order to get his handiwork to the water. The moral of this, as applied to our workman, is not so much that he could not get the car out of the cellar, but why build it there when he would only have to provide a place subsequently for its storage? If it is necessary to build a garage of some sort, far better it is to build the house before starting the car.

Constructional Features

A brief inspection of the drawings will disclose the fact that this is essentially a car without springs. The construction is so simplified through the elimination of the conventional spring that the loss of this important member is believed to be justified. At the same time, if the complications arising through the introduction of semi-elliptic springs, particularly at the steering gear, can be tolerated, the builder is by all means advised to insert them. As it appears in the drawings, however, the car has certain spring qualities inherent in its construction. The members which support the weight of passenger, body and engine, are struts of ash and obviously they form springs in themselves. The body and hood of the car stiffen the struts to such an extent that they bend only at points near the center.

The wheels are of the standard motorcycle type or even substantial bicycle wheels, if the latter are the more readily obtained. Steering is accomplished through the usual knuckle arrangement, which has many advantages over the method in which the entire front axle turns. The drive to the rear wheels is by means of belts which are arranged in such a manner that they may be tightened through the agency of idlers controlled by a convenient lever. Braking is accomplished by tightening a piece of steel cable around a pulley affixed to the hub of each of the rear wheels, the brakes being applied by a foot pedal.

The differential gear was omitted owing to its complexity and not through lack of recognition of its great importance. The narrow tread of our car,

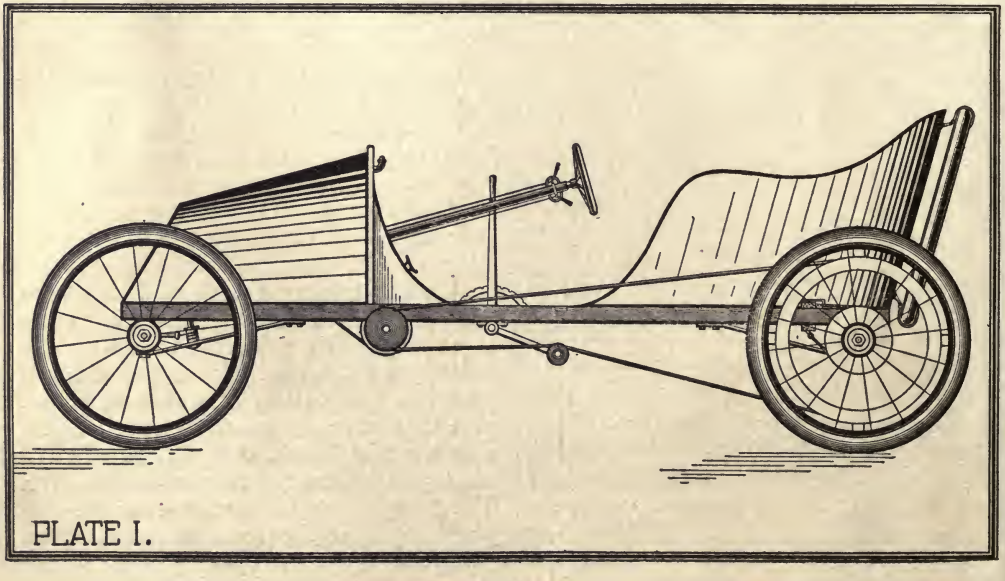


PLATE I.

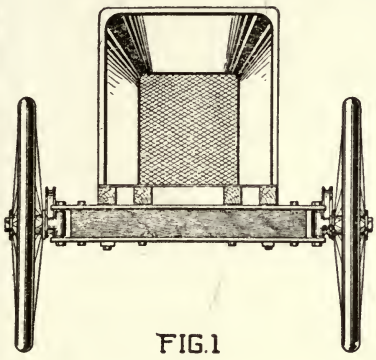


FIG.1

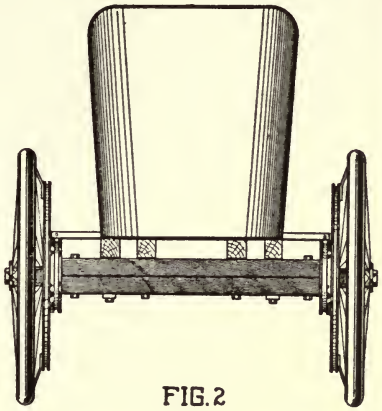


FIG.2

PLATE II.

together with the fact that in turning a corner the driver would naturally ease up on the driving idler in order to reduce the speed, will serve to make up for the omission, and the absence of the differential will scarcely be felt.

While the design shows but a single seat, the chassis is sufficiently substantial for two passengers. While the double seat may be of the side-by-side variety, the tandem arrangement is strongly advised in order that the weight may be kept well centered. In the event of tandem seating, the "body" proper can be dispensed with and two light seats mounted, one in front of the other, directly upon the struts, by means of steel rods forming the legs of low chairs, as it were.

With the foregoing description of the car and its general characteristics, it is assumed that the reader will by this time have a fairly good conception of the various drawings, and we shall accordingly turn our attention to the details of the parts in the order of their assembly. Very few dimensions are given, as it is believed that they are confusing, as a rule, and not conducive to a thorough understanding of the construction. The drawings are all to absolute scale, however, and the scale at the bottom of the drawings is appended in order that it may be cut out of the page and used upon the reproduction to serve the purpose of a rule.

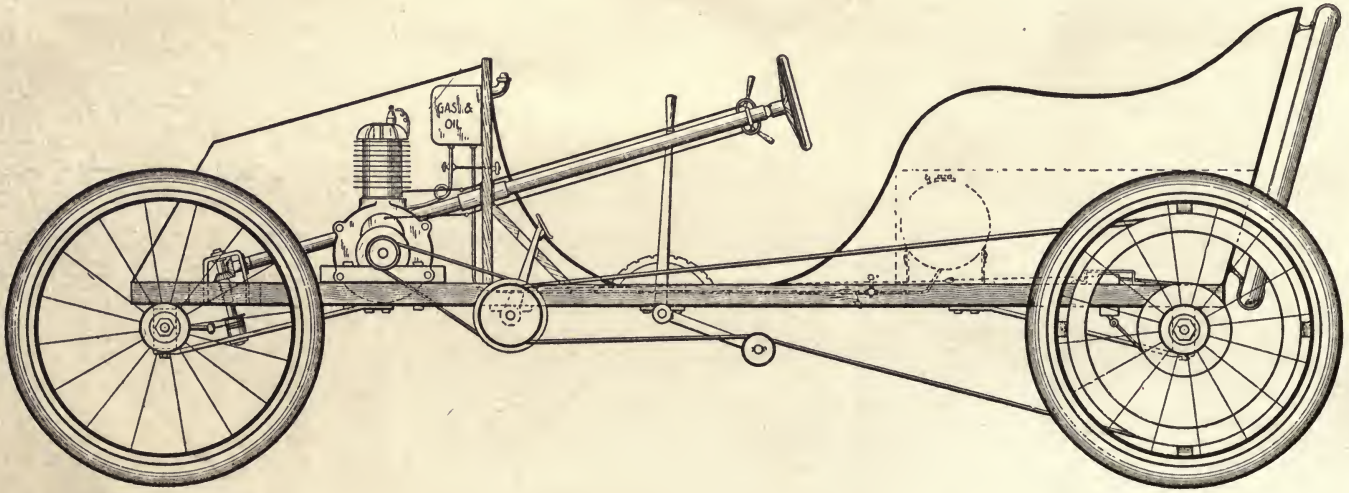
Details of the Chassis

The basis of the chassis is a group of four struts of 2 x 2 inch ash, 96 inches long. These timbers should be very thoroughly seasoned and perfectly straight when they come from the mill, where they should be planed or sanded and cut to the finished size.

The axles upon which the struts are mounted are of maple and cut to size at the mill. The front axle is of 2 x 3 inch stock, 26 inches long. The rear axle is of 2 x 4, 28½ inches long and divided through its center as shown in Plate II, Fig. 2. Through the center is bored a hole to take the axle proper, which is of one-inch wrought iron pipe. This pipe measures slightly more than 1¼ inches on the outside, and, as the reader probably knows, the one-inch applies as a pipe size rather than as a dimension. The inside dimension of the pipe is practically an inch. The rear axle, combining pipe and wood, is secured to the struts by means of bolts passing through strut, wooden piece, and pipe. A brace of half-inch cold rolled steel stiffens the axles, both front and rear, as shown in the side elevation, Plate III.

With reference to Plate VI., Figs. 1

SIDE VIEW



Scale

PLATE III.

PLAN VIEW

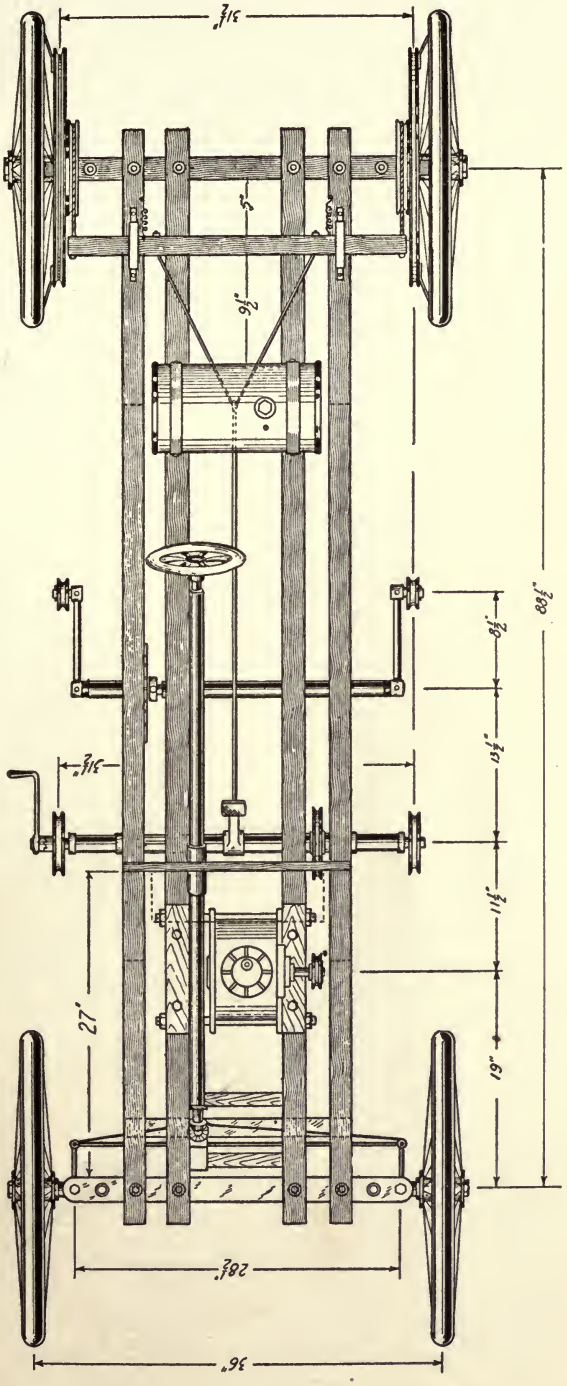


PLATE IV.

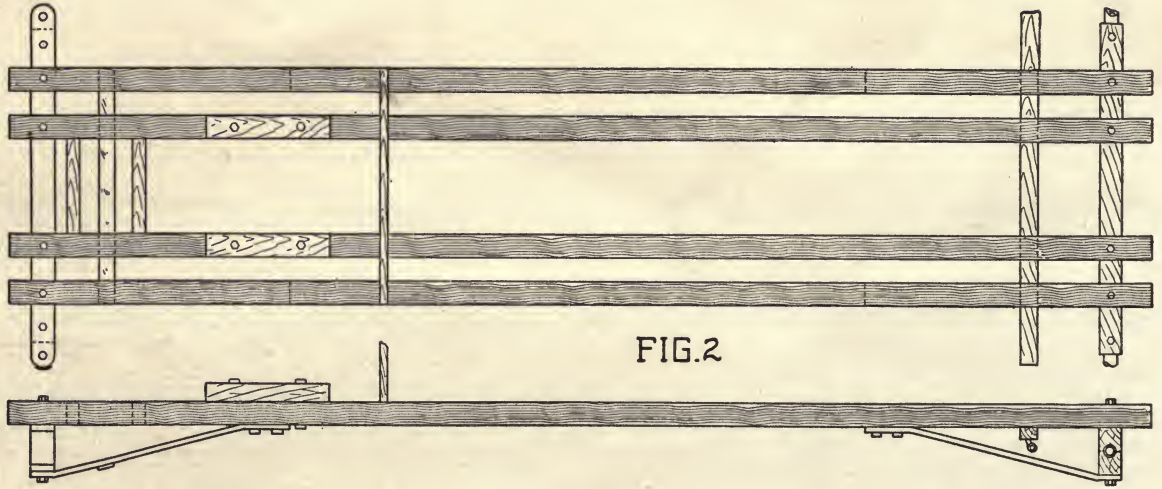


FIG. 2

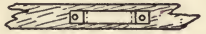


FIG. 1

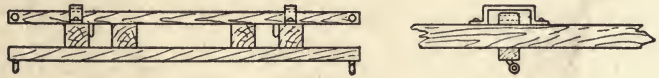
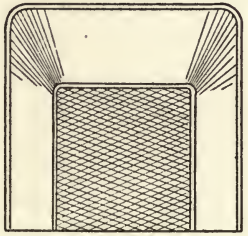


FIG. 3



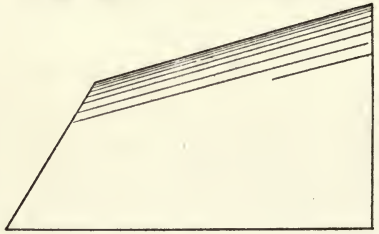


PLATE V.

and 2 show the details of the steering knuckles. The front axle carries, on its top and bottom, bars of cold rolled steel ½ inch thick, which extend beyond the ends of the wooden piece to form the bearings for the knuckles which carry the wheels. These knuckles are made up of one-inch wrought iron pipe tees, lined with nipples, and fitted with the extensions of the axles of the wheels. The steering gear proper is shown in Fig. 2, which discloses the method by which the steering wheel operates a drum upon which is wound the steel cable connecting with the steering knuckles. The arrangement is similar to that employed with the tiller of a boat. The wheels are maintained parallel through the agency of the distance rod, which links the extensions of the steering knuckles together.

Power Plant and Drive

The use of a standard motorcycle engine of from three to seven horsepower is contemplated. The method of mounting shown is purely suggestive, as there are so many makes of engines on the market that it is difficult to present any one mounting that would serve for all. The plan suggested is merely to run studs through the lugs on the crankcase, bolting down these studs to the central struts of the chassis in the manner shown in the side elevation and plan views, Plates III and IV.

The pulley supplied with the motor will undoubtedly serve the purpose, and upon its size and the power of the engine will depend the diameter of the intermediate or countershaft pulley. The reduction shown in our drawing is about 2:1, this being suitable for the small, single-cylinder motors so commonly used.

The countershaft requires some attention. In Plate IV the reader will notice that this member is carried in a series of bearings made from pieces of pipe, into the ends of which standard annular ball bearings are fitted. These bearings may readily be purchased and it is comparatively a simple matter to fit them to the supporting members. The pipe is secured to the struts by means of strap-irons bolted on. The countershaft carries the central pulley, taking its belt from the engine shaft and, also, at both ends carries the drive pulleys from which the belts pass to the rear wheels. The shaft extends beyond the pulley on one end in order that a starting crank with ratchet may be added if desired. This crank is, of course, removable.

In the center of the countershaft housing will be noticed the brake pedal which pulls the slender rod extending back to the brake bar. This bar is slidably arranged on the struts in order that it may be drawn forward to tighten the steel cables which pass over pulleys on the drive wheels. The other ends of these cables are fastened to the ends of a cross piece which may be seen in Plate III.

Immediately in the rear of the countershaft may be seen the belt idler and its control mechanism. This consists of a shaft carried in two pieces of pipe, which are fastened with strap-irons to the struts, a long lever by means of which the shaft is turned and, at either end of the shaft, an arm carrying at its extremity an idler pulley. The parts of the idler mechanism may be gotten out in castings quite readily, as the pattern work is comparatively simple. The details of the device are very clearly shown in Plate VI, Fig. 5.

To pass now to the rear wheels and their pulleys. If the builder can secure two standard motorcycle wheels with pulleys attached, well and good, but if the substitute must needs be a bicycle wheel, an improvised pulley may need some thought. Perhaps the simplest way out of the difficulty is to build up a pulley from some good, dry, hard wood in three thicknesses, crossing the grain three ways. Instead of glue, heavy varnish may be liberally used between the layers of wood, which should be about ½ inch thick. The final holding with a series of rivets spaced a few inches apart and near the periphery will prepare the pulley for turning. The center is taken out as the pulley is fastened to the rim of the wheel by means of straps of steel. The final treatment of the pulley should be a liberal impregnation with some good

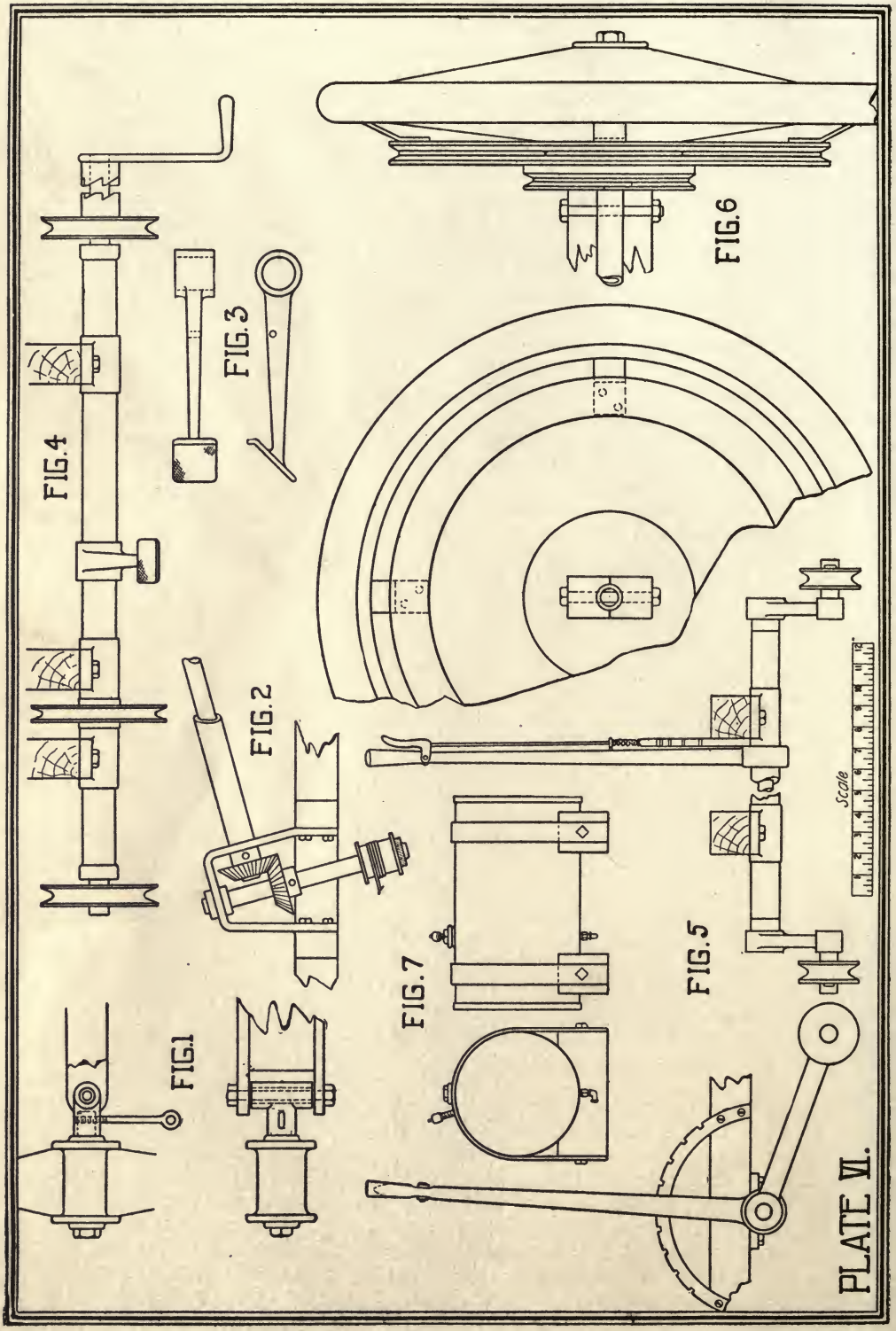


FIG.1
FIG.2
FIG.3
FIG.4
FIG.5
FIG.6
FIG.7
Scale
PLATE VI.

waterproofing compound over which the finishing paint may be applied.

The smaller pulleys serving as brake drums may be made up in the same way, but their rims should be lined with steel ribbon, as the friction of the cable would soon cut the groove too deep. These pulleys are to be fastened to the hubs of the wheels. A secure method to accomplish this is to let the sprockets into depressions cut in the pulleys, thus forming an effective key.

The belting may be heavy, round leather, or it may be standard motorcycle belting which has a V-section to fit the groove in the pulley.

The ratios of the various pulleys as shown in the drawings will make for good hill-climbing qualities rather than speed, and in view of the absence of springs, it is quite likely that the ability to pull under all conditions will prove more desirable than would the greater speed to be obtained through a smaller reduction.

Between the rear axle and the belt idler will be seen the reserve gasoline tank, the function of which is to carry a greater supply of fuel than the main running tank—shown on the dash—is capable of holding. The system of piping and distribution is so clearly shown that it needs no further description. The details of the mounting are given in Fig. 7.

The fitting up of the dash with the control devices, such as the switches for ignition, fuel and oil handles, is best left to the individual builder. A suggestion for the spark advance and throttle levers is given in the side elevation, Plate III. This arrangement is exceedingly simple and it is probably as satisfactory as any within our reach. The termination of the two rods is not shown, as the carburetor and distributor are seldom in the same place on any two makes of engines.

The hood and body of the car are of heavy sheet iron. Plates I and II show the general appearance of the construction. The patterns for the metal should be laid off on heavy paper and cut to shape. In order that the accuracy of the patterns may be tested, they should be bent up and placed on the chassis. The edge of the metal forming the body should be turned over heavy steel wire in order that it may be stiffened and finished.

The hood should be quickly removable as a whole in order that access may be had to the engine. A simple hook fastening will suggest itself to the builder. If difficulty is experienced in keeping the engine sufficiently cool, a second opening may be made in the top of the hood near the dash and fitted with wire netting, as is the front.

The upholstering of the seat is a matter for the builder to decide. A covering of pantasote over a spring seat of the usual type will provide a cushion of good appearance and comfortable riding qualities.

In closing, a few suggestions regarding changes in the design may not be inappropriate. The length of the steering rod, for instance, should be determined by the build of the driver; the distance from the foot board to the rear of the seat is another consideration; the elimination of the hood and body would improve the riding qualities of the car by providing a longer spring in the struts; variable speed could be secured through the addition of a friction disc drive—an appliance not difficult of construction. These and a dozen and one other improvements or alterations will suggest themselves to the prospective builder who applies himself seriously to his task.

As a last word to those who have followed this necessarily brief description to the final paragraph, let the author suggest that standard parts can be obtained in great variety and builders are by all means advised to purchase such parts rather than try to improvise them if a car of durable qualities, capable of long and practical service, is desired. At the best, the car described is scarcely more than a makeshift vehicle intended to furnish amusement in much the same manner as would a bob sled or an ice boat. If, in presenting this design, the author has done nothing more than to offer some suggestions which may prove of assistance to the amateur mechanic who has aspirations toward the building of a real cycle car or light automobile, he shall feel that his efforts have certainly not been in vain.

Electric Lights for the Summer Cottage*

IN planning the system of distribution for the current at the low potential of six volts, we have first of all to consider ways and means for getting the current to the lamps by the shortest possible route in order that the already low voltage may not suffer a serious drop. In this manner we also effect a saving in copper, as a short line does not have to be of as heavy a conductor as would be the case if the transmission were over a long wire. The plan of the cottage under consideration readily adapts itself to a short and simple wiring diagram as the reader will note upon reference to the illustration on the facing page.

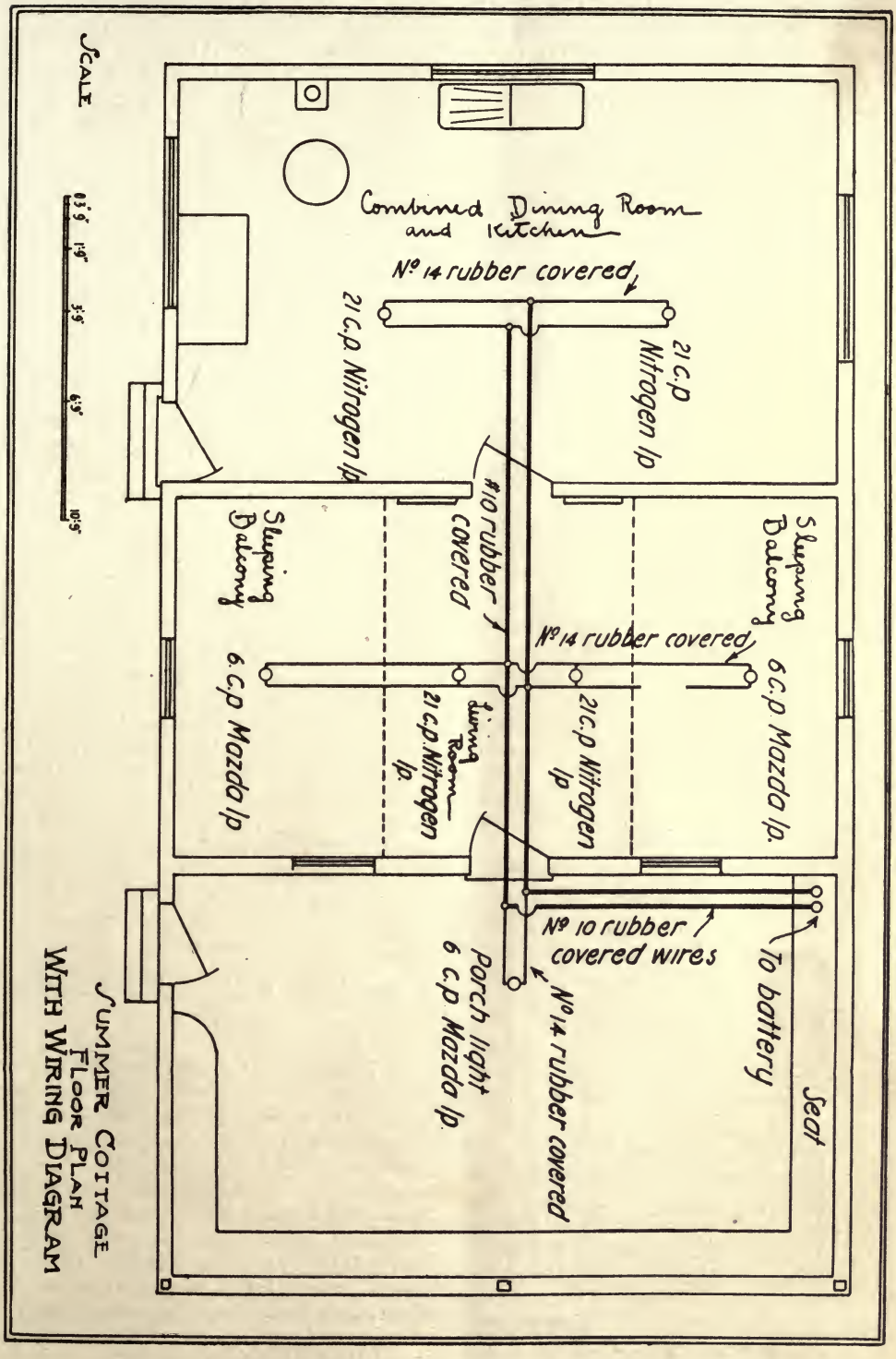
As outlined in the preceding article, the plan is to employ 21-candlepower, nitrogen-filled, six-volt lamps for the living room as well as in the combined dining room and kitchen. The sleeping balconies and the porch are to be lighted with six-candlepower, six-volt mazda lamps. The battery is to be one having a capacity of from 80 to 100 ampere hours and the suggestion is to charge the battery from the generator on the automobile or motor boat during the day. This necessitates the removal of the battery from the house for charging, but the annoyance is slight, and if the user is willing to put up with the trouble, he may save the cost of a generating plant thereby. It is realized, of course, that perhaps some of those who build the cottage will not be the fortunate possessors of either a car or a boat, and in such an event the only recourse is to an isolated plant combining a small generator and gasoline engine. The installation of such a plant, low in cost and simple in operation, will be described in the next article.

The wiring diagram discloses the battery beneath the seat on the porch. Where space is at a premium, as in the present instance, the natural closet room afforded by the porch seat offers an opportunity that should be taken advantage of. Furthermore, in view of the fact that this installation is purely a warm weather one, it is just as well for the battery to be placed outside the sleeping and living quarters in order that any possible fumes arising from the acid may be readily carried off. Anticipating the next article a bit, we may add that the porch seat also provides room for the entire charging plant in the event that it is installed. Therefore, the logical starting place for the mains is beneath the seat and near the wall.

Tracing the conductor, which should be of No. 10 rubber covered wire, we follow it up the side of the cottage on cleats until it reaches the ceiling of the porch which it follows to the front door. Here a tap of No. 14 rubber covered wire is taken to provide the branch circuit for the porch light. This outlet may terminate in a standard dome such as is used on the ceiling of a limousine car. The control is preferably through a snap switch just inside the front door of the cottage.

To continue the mains, however, we find that the No. 10 wire is carried in a straight line through the center of the living room to the dining room. At the

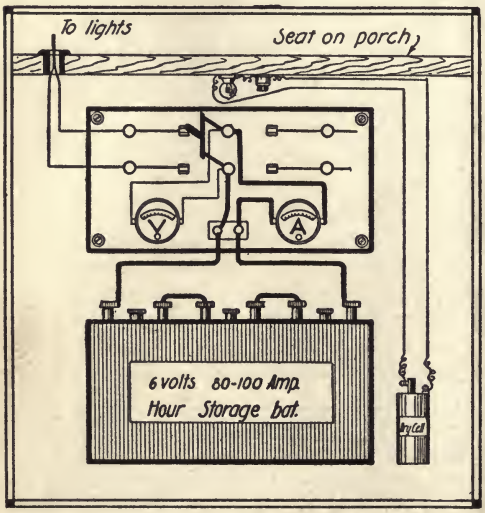
*Continued from the June number.


Combined Dining Room and Kitchen
No 14 rubber covered
21 c.p Nitrogen lp
21 c.p Nitrogen lp
Sleeping Balcony
6 c.p Mazda lp.
No 10 rubber covered
No 14 rubber covered
Sleeping Balcony
6 c.p Mazda lp
Living Room
21 c.p Nitrogen lp.
21 c.p Nitrogen lp
No 10 rubber covered wires
To battery
No 14 rubber covered
Porch light
6 c.p Mazda lp.
Seat
SCALE
0 1' 2' 3' 4' 5' 10'
SUMMER COTTAGE
FLOOR PLAN
WITH WIRING DIAGRAM

center of the former a branch of No. 14 extends in either direction to provide outlets for the 21-candlepower living room lights and the six candlepower lamps for the sleeping balconies. The former lamps may be carried in fittings suited to the furnishings of the room. For instance, if a library table occupies the center of the floor, a suitable fixture would be a double ceiling pendant with mission lamps. On the other hand, if a broad, practical illumination for the entire room is desired, there is nothing better than the automobile dome light suggested for the porch. The fixtures over the sleeping balconies may be simple receptacles.

For the kitchen and dining room the outlets at the ends of the branch of No. 14 wire may be ordinary droplights with shades. The light here should be serviceable rather than ornamental in order that the camp's chief cook and the associated dishwashers may have plenty of illumination while engaged in the pursuit of their important tasks on the evenings of dark and stormy days.

The wire may be carried either on cleats or in wooden or metal moulding. The wooden moulding is perhaps to be preferred, as it is inexpensive, easy to install, and, what is more, it may readily be stained or painted to harmonize with the decoration of the ceiling. The outlets may come in wooden blocks of standard construction upon which the miniature fixtures are secured. No snap switches have been suggested with the exception of the one for the porch light, as the individual worker will place them where convenience dictates.



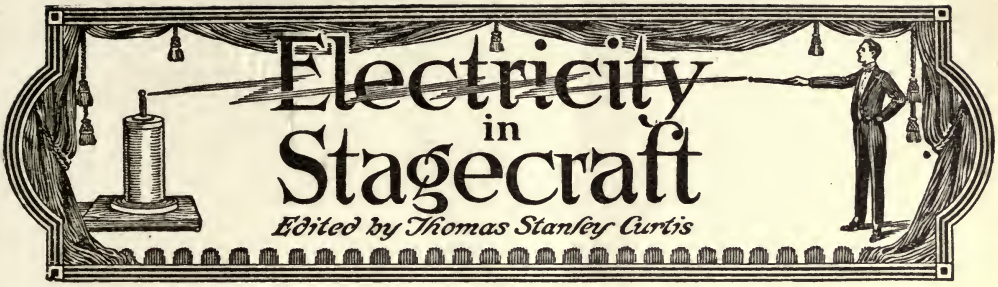
Arrangement of Storage Battery and Switchboard Under Porch Seat.

To return to the battery and its housing. A simple switchboard should be made as depicted in the drawing showing an interior view of the closet beneath the porch seat. The switchboard should carry a double pole, double throw knife switch, a cut-out fused to 10 amperes, and a battery voltmeter and ammeter. Above the board is fitted a miniature lamp which should preferably be operated from a single dry cell placed beside the storage battery. The diagram of connections is shown in the drawing, and a moment's study shows us that the switch, when thrown to the left, places the battery in circuit with the house mains leading to the lamps and, at the same time, permits an examination of the condition of the cells to be made while they are in use. For instance, if the voltage is below six when the ammeter reads two amperes or more, the battery needs recharging. Under good working conditions, the voltage should be slightly over six when the full load is on.

Throwing the switch to the right disconnects the house wires and places the battery in a circuit which may be used for charging through the addition of a generator and engine.

A SPRING WHICH FLOWS GASOLINE

A phenomenon which is so far unexplained has been discovered at Amherst, Ohio, in the nature of a spring which flows gasoline. At first it was supposed that this was caused by the leakage of some gasoline tanks from nearby garages. The tanks have been thoroughly examined, however, and found to be perfectly tight, and the mystery remains. About two or three gallons of pure gasoline flows from the spring every hour, it is estimated, and a lighted match readily ignites the spring's discharge.



The Electrical Entertainer's Program*

SOME of the most startling and spectacular experiments of which the high frequency apparatus is capable are produced in connection with the insulated stool and the charging body of the performer. For most of these experiments, the frequency of the current should be increased by moving the primary clip of the oscillation transformer to a point where fewer turns are included in the circuit. This will reduce the spark length of the coil, but this loss can be tolerated in view of the fact that the current is smoother and the muscular contractive effects are totally missing. It is difficult for the performer to do justice to his experiments if he experiences any degree of shock, which, while not at all dangerous, is still disconcerting.

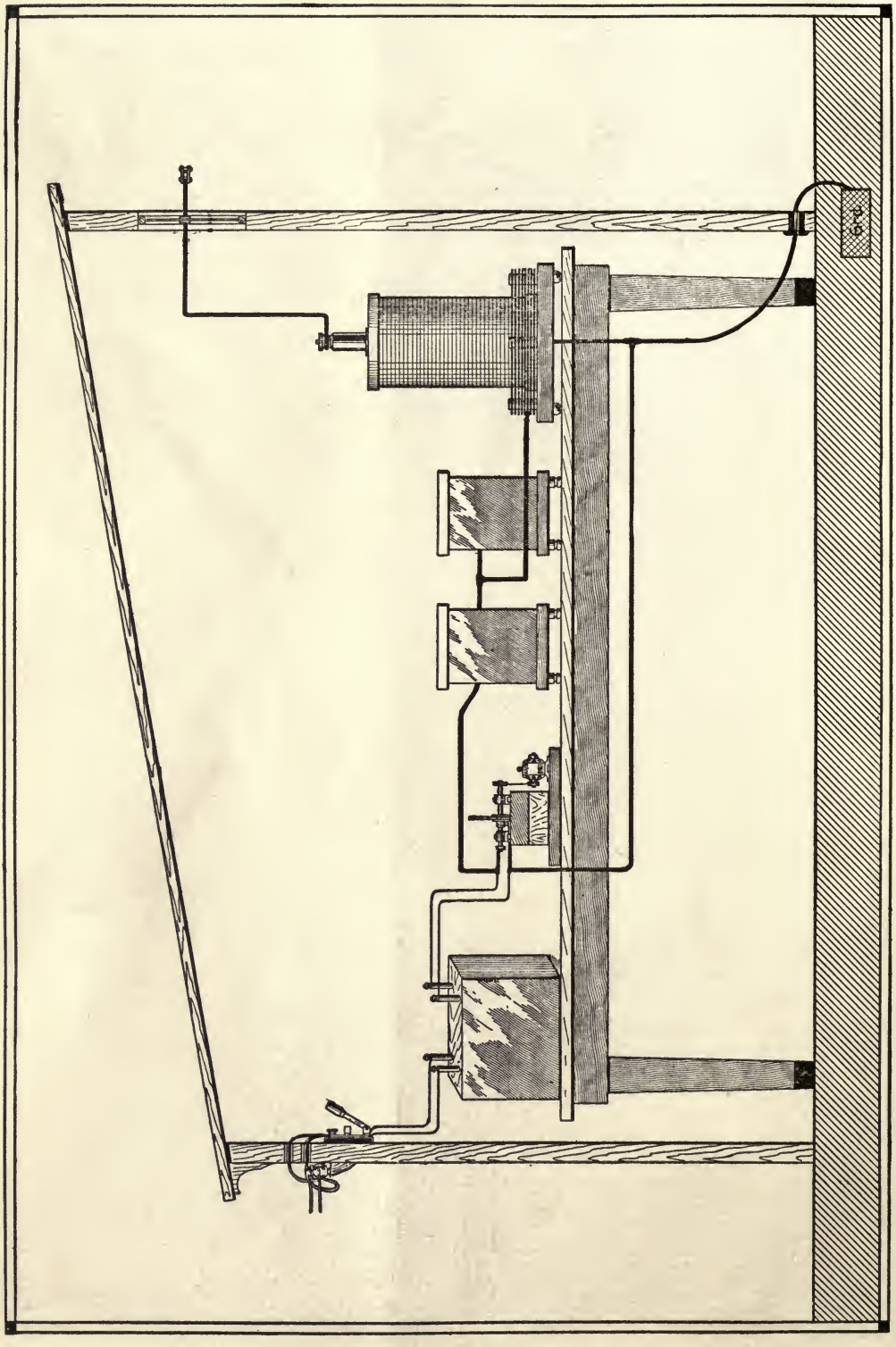
The performer stands on the stool and touches the discharge ball of the coil with his metal wand. When the current is turned on, a strong, snapping spark several inches in length may be drawn from any portion of the body by the assistant. This spark will ignite a piece of cotton dipped in alcohol, light a cigarette, puncture a thin piece of glass, and do many other equally interesting tricks. If the spark is taken from the bare skin for any length of time, a blister will form from the burn which results, and it is therefore advisable to draw the spark from a heavy ring worn on the performer's free hand. An occasional spark taken for a few seconds at a time will not affect the skin and the lighting of the cotton may be accomplished by the assistant bringing the material in close proximity with the performer's ear or chin. *Care should be taken to avoid sparks near the eyes.* If the performer holds a metal spoon in his mouth, a spark may be drawn from the handle and this experiment seldom fails to bring applause.

If the primary clip on the oscillation transformer is carefully adjusted after the performer has been connected with the discharge ball, a point will be found where his body seems literally to exude a luminescent halo of bluish white fire. When the free hand is raised directly over the head, little tongues of fire dart from the finger tips into the air. When a second person approaches to within a foot or so of the performer the space between their bodies is apparently filled with a luminous vapor, and a finger pointed at the performer instantly calls forth an intense, cone-shaped stream of the light. A geissler or other vacuum tube brought to within even six or eight feet of the charged body lights up with its characteristic glow, and, when it approaches to within a foot of the body, the glow is practically as bright as it would be if the current were passing into it through a wire instead of through space.

An entertaining experiment is to bring an incandescent lamp bulb, held by its

(*Continued on page* 116)

*This article is one of a series that has appeared in past issues of *Modern Mechanics* and THE WORLD'S ADVANCE since September, 1914. Previous instalments have covered the construction of the apparatus referred to in this article. The series will be completed in the August issue. The demand for the back numbers has been so great that several issues are now out of print and can no longer be supplied. The author has in preparation, however, a very complete book dealing with this subject in a thorough manner and interested readers may obtain information relative to the work through our Book Department.



Electricity in Horticulture

Edited by Thomas Stanley Curtis

Plant Culture by High Frequency Current*

Part V. Installation of the Apparatus

IN the four past instalments of this series, the reader has been told how to construct the apparatus necessary for the cultivation of plants and vegetables by means of the high-frequency current. The various instruments described were the transformer, which steps up the commercial lighting current of 110 volts to a pressure of several thousand volts, the condenser, which stores this high voltage current, the spark gap, which permits the stored-up current to discharge, and, finally, the oscillation transformer, which converts the high-frequency current, generated through the discharge of the condenser, from a potential of a few thousand volts to one approaching the 100,000 mark. It is this high potential, high-frequency current that we shall employ in the electrification of our plot of ground, and the object of the present article is to point out how the various instruments of the outfit are connected and combined to produce the current.

The entire outfit should be housed in a perfectly weather-tight shed. The construction of the building may be comparatively crude, if the precaution is taken to carefully seal all cracks and crevices, not only in the walls, but around the door as well. In rainy weather, or even when the humidity of the air is high, the inside of the shed should be kept dry and warm by means of a small oil stove. Dampness is positively fatal to the successful operation of the apparatus if it is permitted to strike in for any length of time.

The shed should contain a substantial wooden table along the rear wall facing the door, and upon this table the apparatus is arranged in the order shown on the facing page. The floor of the shed should be at least one foot above ground and an open air space should be left beneath in order to frustrate dampness so far as is possible. A simple and good construction is to build the shed around four substantial corner posts, starting the walls a foot above ground. The roof should have a generous slant to shed the rain.

With reference to the first drawing, the apparatus is arranged in the following order, left to right: Transformer, spark gap, condenser and oscillation transformer. Upon the wall to the left is secured the main switch, which should incorporate a cut-out fitted with 15 ampere plug fuses. To this switch from the outside of the shed lead the line wires, which are to be supplied with a 110-volt, 60-cycle alternating current, preferably from the local central station. It is recognized that in some outlying districts the current cannot be obtained and for the benefit of experimenters so situated a later series of articles will describe the installation of a suitable isolated generating plant.

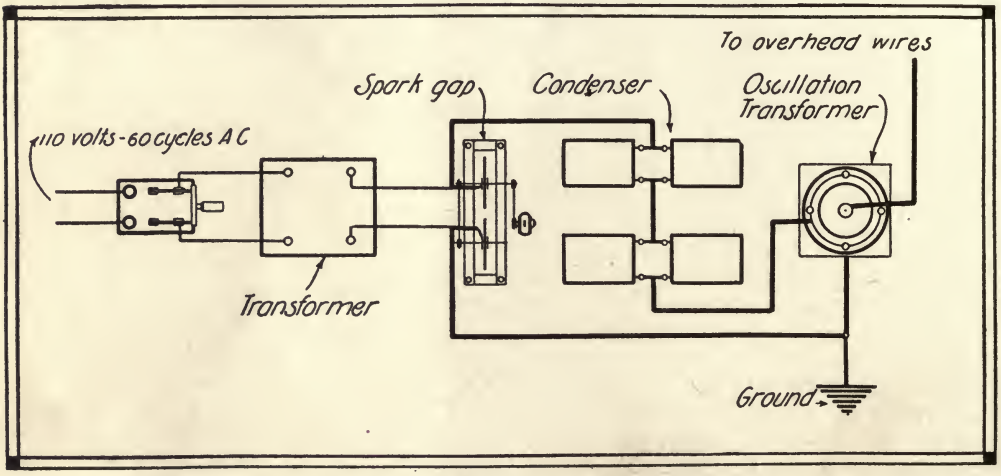
Beside the main switch, the switch for the spark gap motor should be located.

*This article is one of a series dealing with various methods of electrical plant culture that has appeared in this publication since September, 1914. The various instalments have dealt with the different methods of applying electricity to horticulture, as well as described the construction of the apparatus required. Back numbers may be secured at 15 cents each while the supply lasts.

The primary terminals of the transformer are to be connected with the main switch, as shown in the wiring diagram below, which also shows the connections for the remainder of the apparatus. From the secondary terminals of the transformer pieces of No. 14 rubber-covered wire lead to the terminals of the spark gap. From one terminal of the spark gap a piece of stranded cable, composed of 100 strands of about No. 24 insulated magnet wire, runs to one terminal of the condenser. From the other terminal of the condenser, a piece of the stranded cable leads to the movable clip on the primary of the oscillation transformer. The second terminal of the spark gap is connected by cable to the ground connection of the oscillation transformer and this in turn to a series of wires buried in the ground beneath the plot to be cultivated.

The high-potential, high-freqency terminal of the oscillation transformer connects with a piece of light copper rod, which extends upward and out of the side of the building, through a hole cut in the center of a pane of glass. This glass window should be at least 18 inches square and shaded on the outside of the building with a contrivance resembling an awning, in order that the surface of the glass may be kept as nearly dry as possible in wet weather. The copper rod passing through the glass is tipped with a connector to which the overhead wires of the plot are secured.

In the next article, the installation of the overhead wires and the operation of the outfit will be considered.



Wiring Diagram for the Connecting of the Various Pieces of Apparatus to be Used in Electrical Plant Culture.

THE HIGHEST DAM

The United States Reclamation Service is at work on the highest dam in the world, at Arrowrock, Idaho. It will stretch across a narrow cañon of the Boise River, 20 miles above the city of Boise, and will be 351 feet high. That is, perhaps, 23 feet higher than the great Shoshone Dam in Wyoming, and 71 feet higher than the Roosevelt Dam in Arizona. It will be 1,000 feet long and 25 feet wide at the top, over which will run a roadway protected by a wall on each side. The dam will hold back sufficient water to irrigate 250,000 acres of desert land.

A German electrician claims to have invented an apparatus by which he can measure the ten millionth part of a second. While no details of the invention are available as yet, it is very probable that electricity is employed for the purpose.

Practical Electro Therapy

Edited by Thomas Stanley Curtis

High Frequency Apparatus*

OF all the various currents delivered by the modern high frequency coil designed for medical use, perhaps none is of greater moment than that which is known as

THE D'ARSONVAL CURRENT.

Lower in potential by thousands of volts than the Tesla current it is nevertheless of extremely high pressure. The statistics given by various manufacturers differ, but an average value seems to be in the neighborhood of from twenty to twenty-five thousand volts. At this pressure it sends from one thousand to fifteen hundred milliamperes through the body without the patient feeling the slightest sensation other than one of pleasant warmth.

The physiological effects of this current may be noted as an increase of bodily temperature, of excretion and secretion, of metabolism, and glandular activity. Probably its most important function, however, is the reduction of blood pressure in cases of arteriosclerosis. The reports made by physicians who have used the modality in this connection are unanimously favorable, and in many cases the treatment has succeeded where practically everything else has failed. Last, but not by any means least, the treatment has decidedly a sedative effect upon the nervous system.

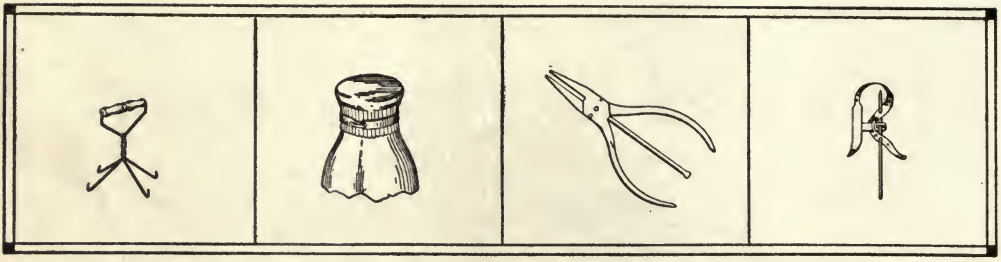
The approved method of application is that known as autocondensation. In this treatment the patient forms one plate or conductor of an electrical condenser while a cushion or other insulator separates the body from the second conductor which is usually a large metallic plate. One terminal of the coil is connected with the patient's body through hand electrodes while the other leads to the plate.

The current passing through the patient's body is measured on a milliammeter which is attached to the case of the coil. While this meter is not essential in case of an emergency, still it affords the only means whereby the physician may determine the dosage being administered, and it is, therefore, necessary if the treatments are to be given intelligently.

The treatment is given either in a special form of chair or else a couch in the upholstering of which the metal plate is incorporated. The chair is preferred by many operators, as in it the patients may recline comfortably without being given the suggestion that they are lying upon an operating table. It is, however, solely a matter of personal opinion with the various physicians whose ideas have been requested. The treatments are equally efficacious in either case.

*This article is the fifth of a series on high frequency apparatus. The first article appeared in the March issue of *Modern Mechanics.*

That motion picture theatres are replacing cheap literature is proven by the fact that English educators have found a decrease in the circulation of this reading matter, following the increase in the number of motion picture theatres. An American bookseller of renown recently closed up shop, stating that the detrimental effect of the motion pictures on the selling of books made the business an unprofitable one.



Recent Novel Patents

A Cuspidor Carrier

Cuspidors are favorite objects for the efforts of inventors, and cuspidor lifters are continually being patented in many different designs. One of the latest of these is shown in the accompanying illustration. It consists of four hook-shaped arms of wire that are joined together and fitted to a common handle. In order to lift a cuspidor it is only necessary to press the device down into the mouth of the container, the arms spreading out and causing the hooks to firmly hold on. The latter can be disengaged by pressing the arms together.

A Milk Bottle Cap

A New York inventor has just secured patent rights on a milk bottle top of original design, which is shown in one of the accompanying illustrations. The top consists simply of a circular piece of paper which has been pressed so as to have a fluted lower portion that fits around the neck of the bottle. A metal band is placed around the fluted portion of the cap and serves to hold it firmly in place.

A Combination Tool

An Ohio inventor has secured patent rights on a design for pliers in which the novel feature is a central piece fitting between the pivoted portion of each plier member and which is fitted with a handle. The inventor does not make clear the reason for providing the extra handle, although he states that the advantage of this design is that each plier handle is independently movable.

A Hat Pin Point Protector

A device for protecting the point of a hat pin has been patented by a Pennsylvania native. It has for its main feature extreme simplicity. This pin point protector is made of one piece of springy metal strip bent in the shape shown and having a short arm soldered or otherwise attached to it. The pin passes through a hole in the strip, thence through a hole in the arm and through another hole in the strip, the spring tension of the latter holding the pin firmly in place. A portion of the strip protects the point of the pin.

A Dresser-Valise

A valise that is made with a drop front and fitted with several trays is the subject of a patent granted to a Kentucky inventor. The valise he has designed may be used as a miniature dresser after the front is dropped down, since the trays may be pulled out like drawers. It is possible to place them at any distance apart. In all other respects the valise is of the conventional type when it is closed, ready for carrying.

A Convenient Screw Driver

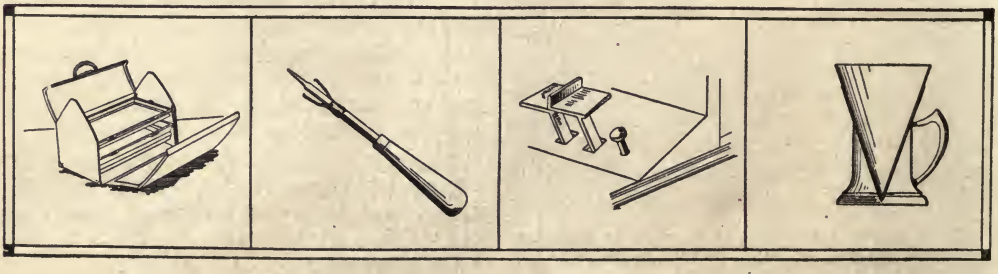
A screw driver fitted with a pair of jaws for holding the screw that is being driven is the subject of a patent granted to an Ohio inventor. The screw driver is fitted with a movable sleeve which mounts the two members that form the jaws. Provision is made for moving the jaws nearer or further apart by simply turning the sleeve, while they may be brought down to hold the screw by sliding the sleeve.

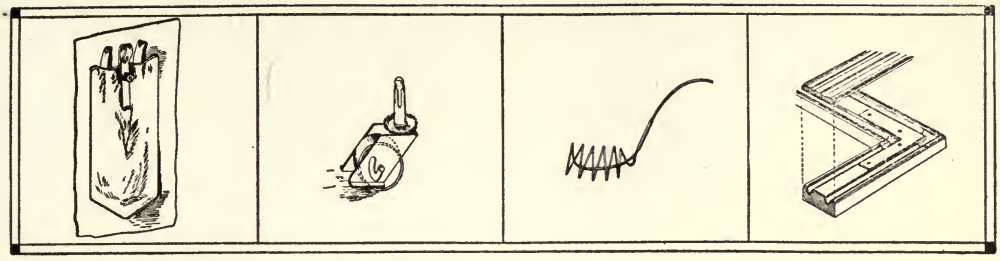
Pedal Controls for Automobiles

In an effort to make the driving of an automobile a simpler task, an inventor of Virginia has patented a form of pedal of the design shown in one of the sketches. The pedal with the overlapping end is that controlling the clutch of the automobile, while the other is the brake pedal. The idea is to couple the clutch and brake pedal in one control, thus requiring but one foot instead of two for operating the clutch and brakes. As the combined pedal is pressed downward, it throws out the clutch, and, when pressed still further, applies the brakes.

A Sanitary Soda Cup

In order to eliminate the usual glass tumblers at soda fountains and replace them with paper cups, a Chicago inventor has patented a holder of peculiar design that takes a conical-shaped paper receptacle. As may be seen in one of the sketches, the holder is very similar in design to some of the holders now in use, with the one exception that it has slanting sides running from the top to the bottom for holding a conical-shaped paper cup. The cup is claimed to be absolutely sanitary, since it is used but once.





Device for Preventing Loss of Tools

An ingenious although very simple device for preventing tools from dropping out of pockets has been invented by a Minnesota native. It consists of a metal strip bent back upon itself so as to form two members, one of which is placed outside and the other inside a pocket. As will be seen in the sketch, the inner one is curved inward so as to hold any tool that may be placed in the pocket. To remove the tool, it is only necessary to push the upper part inward so as to move the inner member out of the way.

An Improvement in Casters

An inventor of West Virginia, has recently been granted patent rights on a simple yet handy type of caster. As may be seen in the accompanying sketch, this caster differs from the conventional ones in that the wheel is not permanently held in one position, but instead may be shifted by means of the slot in which its axle is held. This construction permits the wheel to be raised and the casing member to come in contact with the floor. The advantage of a caster of this kind is immediately apparent; the piece of furniture may be moved about with ease and when it is desired to leave it in one place, the caster may be adjusted so that the furniture stands on rigid feet.

An Improved Egg Beater

A woman inventor has recently patented an egg beater of unique design and which is illustrated in one of the accompanying sketches. The device consists of a single piece of resilient wire bent in the shape shown. The convolutions of wire are made in such a manner that when in use the spiral member bends to conform with the size and shape of the dish or pot.

Electric Light Moulding

A New York inventor has just patented a combination wood and metal moulding which, while possessing the neat appearance and ease of installation of the wooden moulding formerly in use, has practically the same electrical qualities as the present metal moulding required by the Fire Underwriters. By studying the illustration it will be observed that the wooden moulding has a metal facing with grooves for holding the wires. The capping also has a metal surface on the side that faces the wire. Special metal pieces are employed at corners and adjacent sections for making electrical connections between the different lengths of moulding.

Device for Wrapping Paper Rolls

Simplicity and usefulness are the two features of a recent invention of a Wisconsin inventor. His device is intended for use on wrapping paper rolls in order to save time and bother. After a piece of wrapping paper has been torn off a roll, it is usually necessary to spend a few moments in finding the new edge and starting the roll again. This is eliminated by the invention which, as is shown in one of the sketches, consists of a metal arm with a short knife edge at one end, pivoted in a suitable piece which grips on the paper knife. The arm is fitted with a spring which causes the knife edge to press against the paper roll. After a piece of paper has been torn off, it is only necessary to turn the roll in order to start a new piece.

A Tool for Repairing Tires

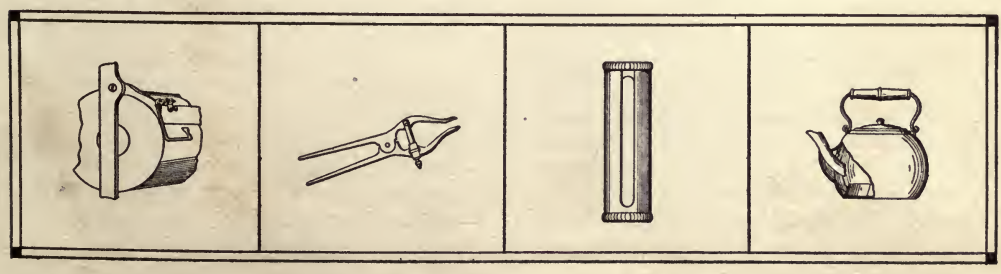
A Canadian has secured an American patent on a tire repair tool of practical design. As will be noticed in the sketch, the tool resembles a pair of pliers, although the pressing of the handles causes the pointed jaws to move apart instead of vice versa. There is also provided a pointed cutting member. The tool is used for making a hole in a rubber tire and then spreading it apart while the scrap rubber is being inserted for making a patch.

A Convenient Match Box

A novelty in the matter of match boxes is presented in the invention of a Connecticut inventor. His device consists of two hollow members which fit one within the other. One end of each tube is closed and finished with a knurled edge, while slots of similar size are cut in the sides of each tube. When a match is desired it is only necessary to turn the tubes around so that the slots coincide, the contents of the match box being then emptied one by one.

Kettle of New Design

A woman inventor of New York has secured patent rights on a tea kettle of new design. Her patent is not limited to tea kettles only, but includes all other spout-provided kettles. The invention is illustrated in one of the accompanying sketches and, as may be seen, consists of a spout of special design as well as a baffle plate at the bottom of the kettle. It is claimed that this style of construction is such that a smooth, controllable stream will issue from the spout.



DIRIGIBLE HEADLIGHTS FOR AUTOMOBILES

An American inventor has recently patented a mounting for headlights which serves to direct the beams of light ahead of the automobile, whether driving straight ahead or around a curve.

The invention comprises pivoted brackets, on which the headlights are mounted in the usual manner. The bracket arms are connected by means of a cross shaft, so that they will turn in unison. Another shaft connects the cross shaft with the steering mechanism of the motor car. Thus, when the steering wheel is turned in order to cause the car to turn a curve, the headlights are also turned to a proportionate degree. The advantage of such an arrangement is immediately obvious; heretofore, when an automobile fitted with the usual headlights turned a curve, the rays of light were cast off the road, leaving the latter in absolute darkness.

COUNTERFEITING U. S. MONEY ON TURKISH TOWELS

The Secret Service Division of the Treasury Department recently received fac-similes of United States paper money, printed on Turkish towels measuring about four feet by two and a half feet. These were sent in as counterfeit money, despite their almost ludicrous size and material, and the Secret Service at once instigated an investigation to discover the whereabouts of the counterfeiters, as the making of spurious American money is a violation of the law. The "towel bills" are in denominations of five and ten dollars, and it is believed that they are manufactured as curios.

GROWING GRAPES ON SAND

A sand dune is about the last place on earth one would expect to see as the base for a vineyard, yet such an extraordinary sight is presented in parts of southwestern France. In the neighborhood of Biarritz there may be seen flourishing vineyards that grow on the dunes of quartz sand cast up by the ocean and driven by the winds.

These vineyards are protected by palisades, and produce great quantities of excellent grapes. They are a modern outgrowth of the ancient Brittany shore vineyards, in which the plants were simply buried in the warm sand, and the grapes were developed almost on the surface of the soil. At that time no means had been devised to protect the vines, and when the wind overwhelmed them with sand the plants were removed to another locality, from which practice arose a local law that treated vineyards as movable property.

A GRIDIRON LAMP

A metal-filament lamp has been produced abroad that is said to afford a more efficient light than the ordinary electric lamp. This is said to be due to the fact that the filaments are arranged in the form of a small square gridiron, fixed horizontally in the center of the globe, and capable of withstanding a considerable amount of vibration. The light is thrown downward, so that illumination is concentrated directly underneath. Tests have been made of the amount of light distributed by this lamp, as compared with the amount given by old-style lamps of equal candlepower. The results are claimed to show that the new-style lamp gives half again as much light.

THE ELECTRICAL ENTERTAINER'S PROGRAM

(*Continued from page* 109)

base in the assistant's hand, close to a rod held in the hand of the performer. The current slowly strikes through the glass wall, and; as the fracture increases, the air is let into the bulb. As the vacuum lowers, the color of the glow in the bulb changes from bluish white to red, then to purple and finally it disappears as the spark punctures the wall and finds its way to the wires inside.

Questions and Answers

This department will appear regularly in THE WORLD'S ADVANCE, subject to following regulations: The questions must be legibly written with typewriter or in ink, on one side of the sheet. Each question must be definite and cover but one point of the subject under consideration, although a letter can contain more than one question. On the 10th of the second month preceding the date of issue of the magazine, all the questions on hand will be considered and those which are put in the most intelligent manner and of widest general interest will be selected for publication in such issue, the number being governed by the space available. All other questions will be returned to the writers with a statement of the price for which they will be answered by letter. Return postage must be enclosed with each letter containing questions, and the letters must be addressed to the Questions and Answers Department and contain nothing relative to other departments of the magazine.

SAYVILLE RADIO STATION.

In reply to the many requests we are receiving from our readers in regard to the operation of the Sayville radio station on Long Island, we will make the following statements, which we hope will clear up the difficulty. Sayville is intended to operate directly with Nauen, Germany, and to send press to the German ships. Since the war has been in progress the German ships have been conspicuous on the high seas only by their absence, so that it would be foolishness to still send press messages out to them. As there is no direct cable communication with Germany, the news has to come by wireless if it is to come direct, so that it has been found more practicable to use the Sayville station only for trans-Atlantic purposes, thus no press messages are being sent as formerly. The call POZ called by Sayville is the Telefunken station at Nauen. There are several wave lengths authorized for the use of the Sayville station, but in general one about 2,800 meters is employed. Sayville's call is WSL.

GENERATOR WINDING.

(1) H. O. P., Elkhart, Ind., asks:

Q. 1.—What should be the winding for a proposed dynamo having an upright bipolar field magnet 6" high, 4" wide, space for winding being 1¼" thick, 2¾" wide, and 3½" long? Bore is 3 1/16" in diameter and 4" long. Armature is H-shaped, 4" long and 3" in diameter. It is desired to get an output of 10 volts, speed being 500 or 1,000 rev. per min.

A. 1.—Although you did not state the material of field magnet, we presume it is of cast iron. It appears to be of good design, differing from most designs submitted to us in that it has more iron. To have the winding space 3" in diameter would be still better. It surprises us, however, to find that you propose to use a Siemens shuttle armature. Even if this is laminated, the operation would be intolerable Sixteen-slot punchings can readily be secured, and from them you can make a first-class drum armature. If you decide to make such modifications in the design of the machine as we suggest, we can then advise you more accurately as to the winding.

WINDING FOR STATOR OF INDUCTION MOTOR.

(2) C. U., Brockport, N. Y., asks:

Q. 1.—What winding should be used on the stator of a certain induction motor of which the principal dimensions are: Outside diameter of stator sheets, 7½"; inside diameter, 4 17/64"; thickness, 1¾"; diameter of rotor, 4 7/32", with 31 copper rods 7/32" in diameter. Stator has 24 slots. It is desired to wind machine for 110 volts and 25 cycles.

A. 1.—For the 4-pole 750-revolution machine No. 18 magnet wire would appear to be about the largest size that will permit the requisite number of turns. You can wind the coils in the manner described in Watson's recent articles on alternating current motor construction. Of course, you are to put on all the turns possible. For a 2-pole 1,500-revolution motor you might use No. 16.

Q. 2.—What is the size of a certain sample of wire sent?

A. 2.—No. 25.

WINDING FOR AN ELECTROMAGNET.

(3) J. E., Ardmore, Okla., asks:

Q. 1.—What would be a suitable winding for an electromagnet having two cores of wrought iron, each 1¾" in diameter and 3¾" long, joined by a wrought iron block having a section 1½" x 2", the current to be taken from ten or twenty dry cells?

A. 1.—You do not state whether the use of the coils is to be continuous or intermittent, yet, from the fact that such batteries are at best adapted for intermittent work, we will propose a winding that will draw a current of only about 2 amperes. If you desire less strength, you can put the cells in two

parallel groups, each consisting of five or ten cells in series. If you desire greater strength, for a few moments only, you can put the two coils in parallel rather than in series with each other. Use No. 18 single cotton covered wire, getting about 70 turns per layer, and 12 layers per spool. Each spool will require slightly over two pounds of wire. Make the flanges of the spools at least ⅝" deep.

FLICKERING OF LIGHTS SUPPLIED BY GENERATOR.

(4) R. R., Humboldt, Kans., asks:

Q. 1.—What is the cause of flickering in the electric lights operated from a certain direct coupled dynamo? Latter is apparently in good shape, and gives 110 volts and 30 amperes.

A. 1.—The causes of flickering may be many, some of them hard to find, and even to remedy. It would be interesting to know the name of the manufacturer of the generator. In a certain case known to the writer, in which there were two large generators in an isolated plant, the causes of flickering were so involved in the design as to be irremediable, and led to the "scrapping" of the machines. Too few commutator segments, irregular spacing of the brushes, unsymmetrical armature winding, unequal spacing of the poles, poor centering of the armature, and poor engine regulation, may be stated as being concerned in the cause. You should certainly seek to remedy the cause, and any progressive manufacturer ought to be anxious to remove all causes of criticism.

PIG ALUMINUM AND INDUCTION MOTOR DATA.

(5) S. McD., Brandon, Manitoba, Can., asks:

Q. 1.—From what firm can he purchase "pig" aluminum?

A. 1.—In the States the principal makers are the Aluminum Company of America, with main offices in Pittsburgh, and works at Niagara Falls. From them you could undoubtedly obtain the address of the nearest Canadian firm with which they are affiliated, and thereby save you the payment of import duties.

Q. 2.—What general dimensions and winding should be followed for making an induction motor of 1/10 horsepower and 3,000 rev. per min.?

A. 2.—As you do not state the voltage and frequency, we are at loss to make any reliable calculations. Possibly you desire a 110-volt machine, and the statement of speed suggests that you have a supply at 50 cycles, for with a 2-pole field that would yield the synchronous speed. With 60 cycles the speed, allowing for "slip," would be about 3,300. It would be worth while to know what range of materials you may have at your disposal, for some accommodation to meet them may be possible. A stator having an outside diameter of 6", inside of 3½", the stack of sheet iron being 1½" thick, would be a good trial size. Have 24 slots, the proportions being about as given in Watson's articles. About No. 20 wire may be used, but arranged for two poles rather than four.

Q. 3.—In making such a motor is it necessary to have any external switches, resistances, reactances, etc.? Such cumbrous adjuncts seem to be omitted from ordinary makes.

A. 3.—While it is true that such starting devices make additional expense, and especially in small sizes of motors are to be omitted if possible, you must face the realization that their omission may mean the retention of certain factors that lessen the regular operating efficiency. Just as in the direct current motors, if you have no starting rheostat, it means that the motor is wound with an inherent high resistance, and has a lower working efficiency than otherwise. Certainly in the case of all large motors, also those used for railway and elevator service, plenty of external devices are involved, and in their design no small engineering skill is shown. You can design a motor poor enough to permit the absence of such devices, or good enough to require them, thereby permitting their losses to be maintained during the starting operations only.

GENERATOR DATA.

(6) W. L., Riverside, N. Y., asks:

Q. 1.—How to wind a laminated field magnet and armature so as to get from 6 to 12 volts. Armature is 1½" in diameter, 2¼" long, with 12 slots 5/16" in diameter.

A. 1.—In consequence of the inability of the laminated structure of the field magnet to hold any "residual" magnetism, you cannot make the machine self-exciting. If it is to be used for charging storage batteries, no difficulty, however, will be experienced, for in that case the electromotive force of the cells may be relied upon to give the initial start. In other cases you would find it necessary to clamp the sheet iron between two cast iron plates, say ⅛" thick, and of the same shape as one of the punchings. You might use No. 22 wire on armature, No. 25 on fields.

QUESTIONS ANSWERED BY MAIL.

For the benefit of those wishing to have their questions answered by mail without the delay involved in answering them in these columns, there is a special service offered to readers only. Questions will be answered by mail within a few days' time if they are accompanied by the fee of fifty cents. If the answers involve extensive calculation and research, the inquirer will be advised as to the fee.

RADIO SECTION

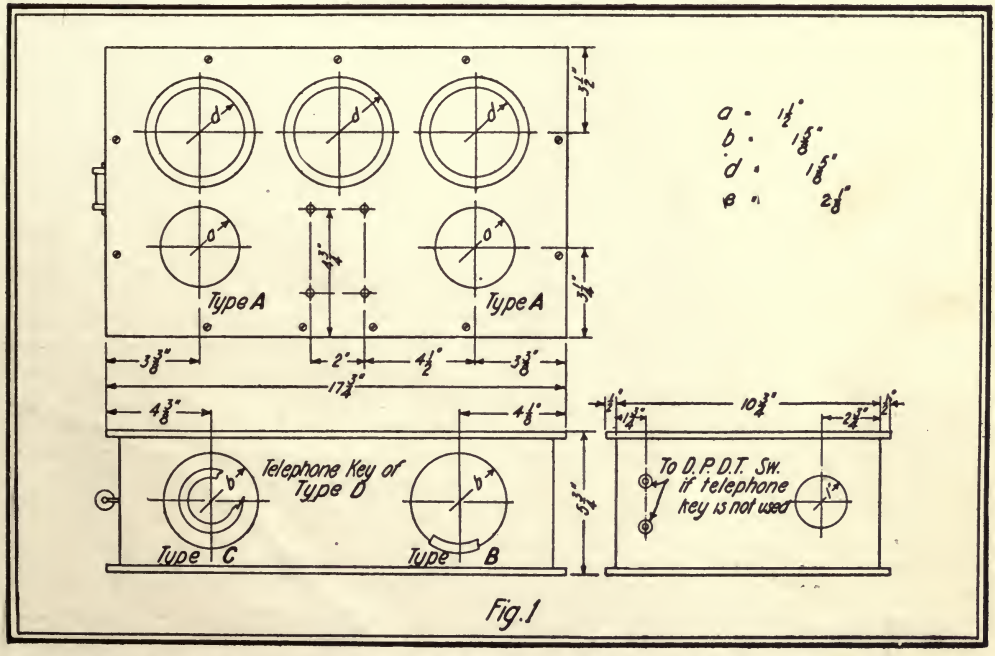
Devoted to the Encouragement of Amateurs and Experimenters in the Field of Radio Communication.

A Multiple Receiving Tuner*

By Chas. P. Seeger

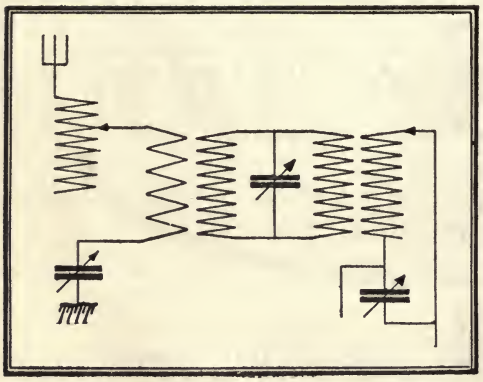
AS a rule, sending outfits are described in greater detail than receptors, primarily because it is necessary to conform to certain rules in setting up a sending outfit. The average receiving outfit described is usually of a simple and common design, no attempt being made to furnish data for a set of apparatus typical of one or the other great systems of radio telegraphy. In the following article the author has endeavored to describe a Marconi type receiving set.

In the Marconi multiple tuner there is an intermediate circuit of low damping interposed between the aerial-earth circuit and the detector circuit. This intermediate circuit has inductive coupling with both the antenna and the detector



Dimensioned Plan of the Cabinet in Which is Placed the Different Apparatus Comprising the Multiple Receiving Tuner.

*This article will be concluded in the August issue of THE WORLD'S ADVANCE.



Wiring Diagram of a Simple Marconi Multiple Tuner, Showing Relation of Different Windings and Condensers.

circuits, and is tuned simply by means of a variable condenser which has a considerable range of capacities. This design of tuner is quite selective, and yet is more quickly and more readily adjusted than the somewhat more selective Fessenden type. Waves impinging upon the aerial, even though highly damped, produce in the low resistance intermediate circuit very feebly damped oscillations, and these can be tuned quite sharply in the detector circuit.

The general diagram of this type of tuner is as follows:

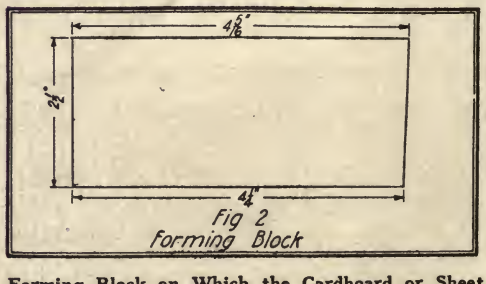
The first circuit—consisting of the loading coil, condenser and primary of the first loose-coupler—is adjusted to respond to the desired wave length. The intermediate circuit is then adjusted, after which the detector circuit is brought to the same period as the rest.

The most important factors in the construction of receiving outfits are the proper proportioning of inductances to capacities in order that the amount of dead-ended wire may be reduced to a minimum, the reduction of distributed capacity, the elimination of sliding contacts, and the use of coils whose natural periods differ considerably from the wave lengths for which they are to be used. Moreover, in inductive tuners the primary and secondary coils must—with the closest coupling—be far enough apart to minimize electrostatic capacity effects between the windings.

The following instructions will enable the construction of an outfit on the order of the multiple tuner, but possessing certain advantages over the above-mentioned tuner in that it is adapted for use with various forms of detectors. The box is to be made of mahogany, preferably, although walnut is also suitable. It is suggested that the box be made with a hinged top in order that the apparatus may be more easily assembled. Retainers are glued to the sides and bottom of the box in order to strengthen the joints.

After assembling, the box should be thoroughly sandpapered in order to remove all traces of glue. It should then be given a coat of mahogany stain, or walnut stain if the latter wood is used. The builder may use a water stain and apply the desired color, after trying various depths of color on a piece of wood.

When dry, the surface should be lightly sandpapered to remove any roughness where the stain may have "raised" the wood. A coat of shellac is then applied and when dry it is sandpapered sufficiently to bring out a smooth surface. This is given a coat of light varnish. When dry, the surface is sandpapered and given a second coat of varnish. When the latter is dry, the builder should obtain a piece of burlap, some "rubbing oil," and the finest powdered pumice stone possible. The burlap is soaked with the oil and sprinkled with the pumice stone to serve in rubbing down the wood. This process requires a couple of hours, but if carefully done it will yield a finish to the box similar to that of a piano. Before sandpapering, it is necessary to make sure that the coats of stain or shellac or varnish are *thoroughly dry*. Great care should be exercised in sandpapering to



Forming Block on Which the Cardboard or Sheet Fibre is Placed.

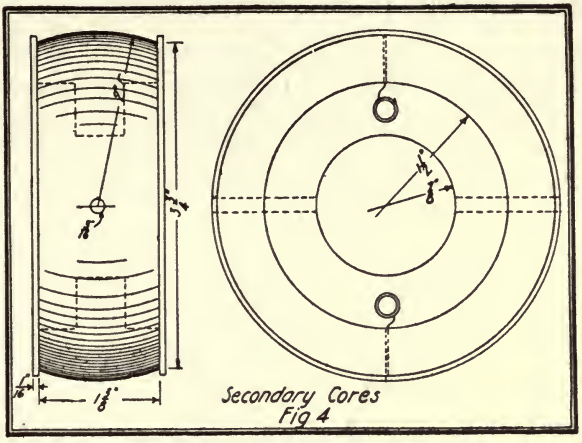
prevent taking off the stain, varnish or shellac. Only No. 00 sandpaper should be used.

While the varnish is drying, work may be started on the inductive tuners, requiring:

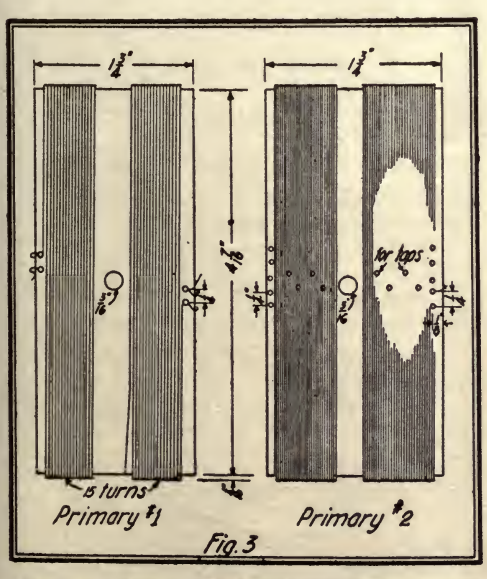
Fiber—about 1 sq. yd. 1/64 inch thick.
Wire—1½ lb. No. 30 s.s.c. and 1 lb. No. 22 s.c.c.

COUPLER PRIMARY: Turn or plane up a cylinder to the size shown in Fig. 2. Cut the cardboard or 1/64 sheet fiber into strips 2¼" wide, thus forming a tube of the material about 3/32" thick. For adhesive material use shellac, or, better still, hot glue. When the cylinder has been formed, wind a piece of tape around it to hold the layers together, and after allowing it to set for a minute remove from the form. The cylinder should be permitted to stand over night and the superfluous glue then washed off, care being exercised so as not to unloosen the layers. When the cylinder is dry it is trimmed to size on a lathe, or fastened to a disc that can be rotated.

The first primary is wound with thirty turns of No. 22 s.c.c. wire, fifteen turns per side, spaced as indicated. The wire is started through a hole bored in the tube—several turns of the wire being passed through the holes to insure holding—the winding being placed on the cylinder as tightly as possible, fastening the wire as in starting. Two or three coats of thin, transparent shellac are applied when the winding is completed.



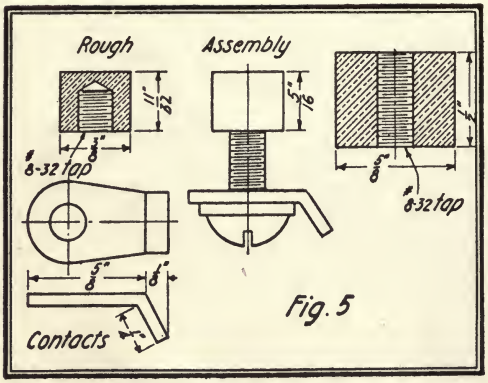
Wooden Spools Which Are Used for Holding the Secondary Windings of the Coupler.



The Two Primary Coils, Showing the Method of Winding.

For the second coupler primary five small holes are bored, using a 1/16" drill, about ¼" apart and ⅛" from edges, as indicated in Fig. 3. One hundred and twenty-five turns of No. 30 s.s.c. wire are wound on, taking taps at 15, 30, 45, 60, 80, 100, 125 turns. In taking these taps, the wire is pushed through a hole in the cylinder, the double wire being then wound as shown, giving it several turns similar to the method of starting, leaving about a foot of doubled wire projecting. The winding is put on as tightly as possible and then given several coats of shellac. When dry, a strip of single thickness empire cloth is wrapped on. On top of this 30 turns of No. 22 s.c.c. wire are wound, starting and wrapping as on the first tuner. Shellac is applied when the winding is completed.

COUPLER SECONDARIES: Turn up the cores of ash or maple to the size indicated in Fig. 4, taking particular care that the radius of curvature of the surface is the distance from the central point on the axis to a point on surface. It is



Details of Switch Points and Connecting Lugs.

also important that the curvature be absolutely regular, for the successful operation of the completed outfit depends largely on the fact that the *secondary cores be exactly alike.* In turning the cores, the builder should make a template of desired radius which can be applied to the surface to determine if the curvature is regular.

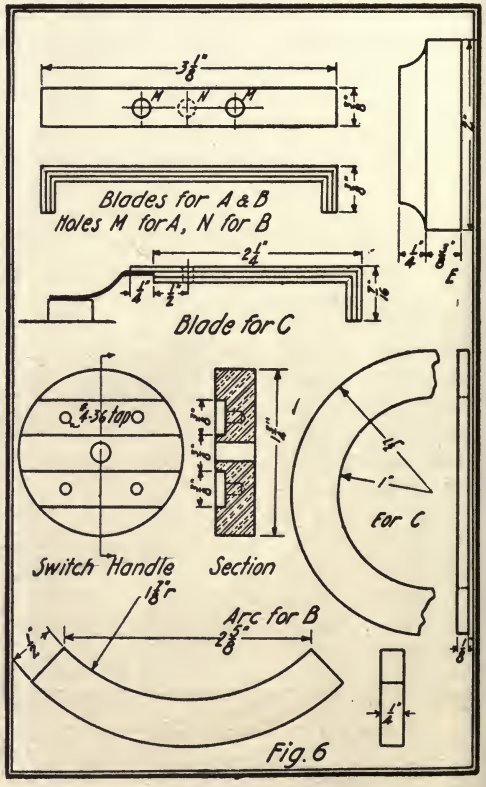
Holes should be bored as indicated with a 1/16" drill, as well as a hole along a diameter with a 3/16" drill. Exactly 31 turns of No. 30 s.s.c. wire should be wound on each side, making the crossover as indicated. The crossover should be 90° on the circumference—one-quarter of the circumference—from the 3/16" hole. It is necessary that these cores hold the same amount of wire, distributed over the same number of turns. The wires should begin and end at small binding posts to facilitate connecting.

LOADING COIL: Obtain a mailing tube 4½" diameter and 7" long, or make one of cardboard or fiber as previously described. It will probably be cheaper to make the tube. Wind on 192 turns of No. 22 s.c.c wire, taking taps at 6, 12, 18 turns, then every eighth turn until 130 turns have been put on. Next tap at 142, 156, 172 turns. Wire is started and taps made in a manner similar to the method used for the coupler, leaving about 8" of wire projecting beyond tube.

CONTACTS: The materials necessary for making the contact points are:

2 ft. ⅜" brass rod.
50 8-32 brass screws—5/8" long.
50 washers or burrs for above screws.

Fifty contact heads should be cut from the ⅜" rod, 11/32" thick. This allows 1/32" for filing. If a bench hack saw, equipped with a vise for cutting bars at right angles is used, these contact heads can be quickly made. Moreover, the cut is smoother than when done by hand and it is at right angles to the sides, thus eliminating a good deal of filing. The pieces should be placed flat on a rather fine file, the contacts being moved and not the file. They are then drilled and tapped for an 8-32 machine screw, with further filing to remove all burrs. The contacts are then assembled on a smooth, level-surfaced piece of wood. A wide fine file is then used to level off the contacts, which are then finished by using the finest sand or emery paper obtainable, the special 00 grade, if possible, placing the sandpaper on a block of wood and taking care not to round contact edges, as well as to use sufficient oil. After all traces of oil are removed, the



Details of Switch Arms, Handles and Contact Pieces.

contacts are polished and lacquered.

SWITCHES: The materials for the switches are:

4 ft. spring, brass or copper.
2" x ⅜" x 8" hard rubber.

Type A.—Cut and bend the copper to the size indicated, and solder the strips together at the point *P*. Drill and tap the brass support on top and bottom for 8-32 screws. The slots in the rubber handle should be no deeper than is necessary to make the blades come flush with the under surface. Drill holes in the blades to clear 4-36 screws at points shown, and in the rubber to tap for the 4-36 screws. Before assembling, sandpaper the brass parts to remove all tool marks, using oil with the sandpaper as in making the contacts. Polish and remove *all* traces of oil before lacquering.

Type B.—The construction is similar to Type *A*, save that it is a single arm switch, and that the arm has a 3/16" hole through center. Slot the handle as before. The metal arc can be made by filing from stock or turning a ring to size. (See Fig. 6.)

Type C.—In Type *C* the switch arm is shorter than in Type *B*, as is shown in Fig. 6, and carries a piece of phosphor-bronze spring soldered to it. The metal ring should be made of ⅛" brass, turned or filed to size. It is best to support it with brass pieces (approximately the diameter of the contacts and held to the case in a similar manner), sufficiently thick to bring the ring to the same level as the contacts. This, however, is not necessary, as the ring may be fastened by drilling and tapping for an 8-32 screw, holding it directly to the case. If this is done, the phosphor-bronze spring will have a deeper bend. (See drawing.)

In place of Type *D* a telephone switch may be used, known as a ringing and listening key. This will eliminate the double pole, double throw switch necessary to change from crystal to audion detector, although it adds considerably to the cost of the outfit.

CHICAGO RADIO CLUB

It is announced that the Chicago Radio Club has recently been formed and will hold its meetings every other Thursday night at the clubrooms in Hamlin Park, Wellington and Robey streets, at 8 P. M. The organization charges no dues. The Business Manager of the club states that he will be pleased to have new members join, in and around Chicago. The main object of the club is to decrease unnecessary interference as well as to increase interest in the art of radio communication.

The officers of the Chicago Radio Club at present are: L. J. Healy, President; Harry Lagodzinski, Vice-President; R. T. Strom, Secretary; Fred Fletcher, Sergeant-at-Arms, and Edw. T. Markowski, Business Agent.

THE MANCHESTER RADIO RESEARCH CLUB

There has recently been organized for the purpose of advancing radio science the Manchester Radio Research Club of Connecticut.

The following officers have been elected: C. W. Hollister, President; Wm. McGonigal, Vice-President; Raymond Carrier, Treasurer; E. F. Ball, Secretary, and Edward L. Root, Electrician.

Wireless amateurs in the vicinity of Buckland, Conn., are requested to correspond with the Secretary, E. F. Ball, of that town.

PITTSFIELD RADIO CLUB

At a meeting held Saturday evening, April 17th, at the home of Allan W. Burke, the Pittsfield Radio Club was formed, with an initial membership of twenty-five. The following officers were elected: President, Allan W. Burke; Vice-President and Chief Operator, Vincent St. James; Secretary, John S. Nichols, and Treasurer, F. Hempstead.

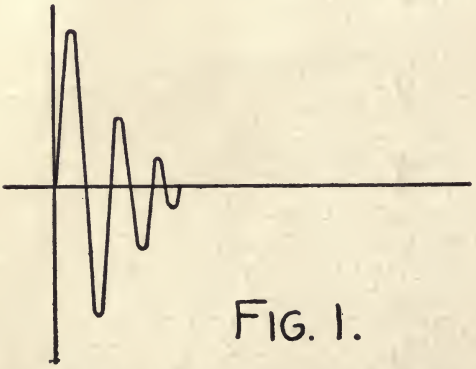
Several of the members of the club have efficient stations and are in communication with other amateurs throughout Massachusetts, Connecticut and New York State.

Spark Gap Efficiency and a New Type Gap

By A. S. Blatterman, B. S.

AS is the case with nearly all of the apparatus used in wireless telegraphy, the spark gap since the first early experiments has undergone a great many changes. In early days the spark gap consisted simply of two brass balls. At that time this arrangement answered the purpose fairly well, though it was realized that blackening and pitting of the surface of the balls, due to the oxidizing and corroding effect of the spark, were detrimental. It was thought at first that the only function of the gap was its action as an automatic switch to suddenly connect the two halves of a capacity circuit charged to opposite potentials, thus suddenly relieving the existing condition of electric strain so that oscillations were produced. This simple property of the gap is indeed a basic requirement, but in modern practice is complementary to another which must now be classed as almost equal in importance for efficient functioning of the apparatus.

With the introduction of higher powers in transmitting it was soon found that the stationary brass ball gap gave rise to a power arc following the first discharge of the condenser, which effectually prevented further oscillations. This was partially overcome by the use of transverse magnetic fields applied at the spark gap to blow out the arc, and with the same purpose a blast of compressed air was often introduced into the gap. Further experience led to the utilization of resonance in the transformer circuits, the inductance in the circuit preventing the heavy rushes of current necessary for maintaining the arc.



Highly Damped Oscillations Produced by a Parallel Plate Quenched Gap.

The spark rate of apparatus using this early spark gap in connection with induction coils, and later with transformers, was very irregular, so that the signal produced in the telephones at receiving stations was of a more or less crackling or sometimes mushy sound, often difficult to separate from the similar sound effects of atmospheric electricity. It was also found by Wien, Austin and others who investigated the subject experimentally that the telephone receiver as well as the human ear is not as sensitive to low pitched sounds as it is to those of higher frequency, in the neighborhood of 900 or so vibrations per second. Accordingly, methods began to be devised for producing regular sparking rates of higher frequency than had heretofore been used.

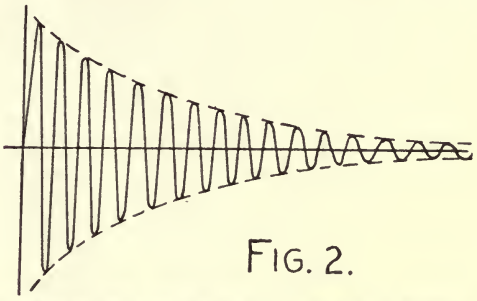
One method employs a disk carrying a number of metallic studs evenly spaced around its periphery and revolving at high speed between stationary electrodes, the whole device constituting an apparatus which gives a regular sparking rate of high tone when used as a spark gap in the condenser circuit. Another method employs an alternator of relatively high periodicity, viz., 500 or more cycles per second, with a special spark gap so constructed and adjusted as to obtain only one spark per alternation. At 500 cycles the ordinary spark gap falls far short of permitting this condition, because the time of an alternation is so brief that any arcing prevents the desired clearing of the gap before the following alternation. Hence, individualization of the sparks is lost and the tonal quality is impure and mushy.

What is required is a rapid regularly recurring discharge which is damped out after a few oscillations. When a circuit containing the usual form of spark gap is coupled to a second circuit the oscil-

lations in the circuits, even when the two are separately tuned to the same frequency, are not simple damped oscillations, but can be analyzed into a complex vibration of two different frequencies.* These two oscillations have different damping factors and the total energy is distributed, not equally, between the two. When the second of the coupled circuits is an antenna this complex oscillation is undesirable and the usual procedure has been to weaken the coupling between the antenna and the exciting circuit, which has the effect of confining the greater part of the energy transferred to one of the oscillations at the expense of the other. While this results in better definition of the radiation as regards singleness and sharpness of wave, there is a considerable loss in efficiency due to loose coupling. An arrangement whereby tight coupling with high efficiency at the oscillation transformer can be utilized and still maintain single wave radiation is much to be desired.

The success of such an arrangement depends on the use of a suitable spark gap. The parallel plate quenched gap is an excellent example of what can be done in this direction. With such a gap, properly adjusted, oscillations in the closed circuit are highly damped, as shown by Fig. 1, and these induce powerful free oscillations in the antenna of single frequency and the damping of which is determined only by the constants of the antenna. (See Fig. 2.) Very close coupling can be used without the appearance of a complex oscillation, because return of energy from the antenna to the closed circuit is prevented by the automatic opening of the latter circuit after the first four or five oscillations. All of the energy of the exciting circuit is transferred to the antenna during these four or five oscillations.

The requirements for this quenching effect are, first, that there be no arcing at the gap; second, that the gap be very short. It appeared that the rotating gap offered great possibilities as far as the prevention of arcing is concerned, owing to the air cooling fan effect of the moving studs which tends to clear the gap of ionized air or metal vapor after each spark, and to the fact that each spark is of relatively short duration, being interrupted by the separation of moving



Powerful Free Oscillations of Single Frequency Induced in the Aerial by a Highly Damped Oscillation Circuit.

studs from stationary electrodes in rotation, thus preventing temperature rise and the complete formation of arcs. It has not been very usual, however, to truly utilize the principle of short gaps with the rotary discharger, for no matter how closely the stationary spark points are set to the plane of rotation of moving points the discharge always anticipates the exact juxta-position of pairs of these points and take place over a considerably longer gap than that indicated. This is especially noticeable at high voltages.

It has been common practice to use two stationary electrodes for feeding energy to the revolving disk; thus, two sparks occur simultaneously in series at every discharge.

The writer has recently had built a gap in which, instead of only two sparks in series, there are eight. By this arrangement the total discharge voltage is distributed over eight gaps instead of two, so that, while the total gap length through the discharger remains practically unaltered, the length of the individual gaps is reduced approximately fourfold.

There is a certain peculiar advantage in thus dividing the discharge among several series gaps. The possibility of arcing is very greatly reduced. Given n gaps of equal lengths in series, the voltage required to sustain an arc in the gaps is approximately n times as great as would be required for a single gap n

*There is also a possibility of a third oscillation.

times as long as one of these gaps. On the other hand, the voltage required to produce a *spark* through such a series of n short gaps is practically the same (in some cases less than) that required to bridge a single gap n times as long. Thus, subdivisions of the total discharge favors the suppression of an arc, yet requires no additional potential to produce sparking.

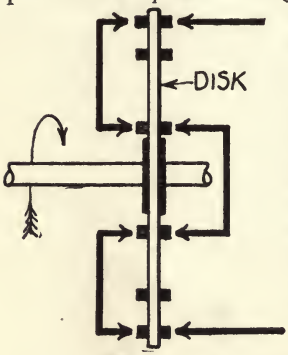


FIG. 4.

Diagrammatic Plan of the New Type of Spark Gap.

The present gap, shown in the illustrations Figs. 3 and 3a, was arranged for non-synchronous operation on 70-cycle supply. The disk is constructed of ⅜" Bakelite and is 12" in diameter. It carries 24 studs, which are threaded into the Bakelite and clamped by lock nuts on each side of the disk. Bakelite is far superior to either fibre or hard rubber in the construction of a disk of this kind, as it can be obtained in sheets of very uniform thickness and does not warp nor absorb moisture.

Some attention was given to procuring a suitable metal to be used for the spark gaps proper. Copper electrodes tend to "bead" in the electric spark; that is, the exposed surfaces become covered with small globules of copper. Zinc, on the other hand, tends to "pit." It has been found that an alloy of copper and zinc, copper predominating, wears down quite evenly, the pitting tendency of the zinc apparently counterbalancing the beading tendency of the copper.

The gap is shown diagrammatically in Fig. 4. It is seen here that eight spark gaps are bridged in passing through the disk. The stationary gaps are arranged as shown in Fig. 5. The electrodes are beveled and set at an angle with the disk, pointing in the direction of rotation. This method effectually prevents mechanical destruction of the gap should stationary and revolving electrodes come into contact. Radiating flanges are provided as shown to aid in dissipating the heat. The electrodes are mounted in Bakelite and those on one side of the disk can be moved as a unit for the purpose of rough adjustments in gap length. For this purpose the disk is also moved along the shaft. The closer adjustments are made by swinging the individual side electrodes themselves in their supports. Considerable care had to be exercised in construction so that all of the eight gaps were in their proper positions for sparking at the same instant. The disk was balanced by mounting on the shaft which was then supported on knife edges. A small 10-24 machine screw was used to obtain exact balance; it was placed about four inches from the center of the disk. The bearings are bronze and no trouble has been experienced from heating.

Experiments to study the behavior of this gap were carried out on a 2 kw. 70-cycle transmitter. The transformer voltage was approximately 20,000 volts (effective), and the spark-frequency used was 700 per second. The gap was found to exhibit properties of pseudo-impact excitation, provided the individual gaps were kept very short. There was also a decided improvement in the power factor measured on the primary of the transformer, readings of 75 per cent. being obtained with eight gaps, as compared with 62 per cent. when only two gaps were used. This is probably due to the decrease in arcing at the gap when the eight gaps were used. An arc at the transformer terminals constitutes a more or less severe condition of short circuit, and a short-circuited secondary is equivalent to an inductive load on the trans-

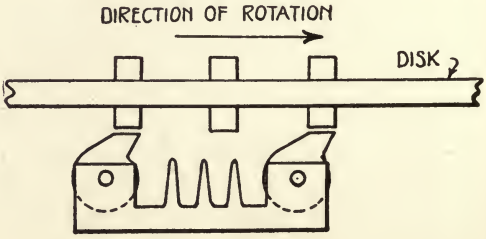


FIG. 5.

Arrangement of Stationary Electrodes of the Spark Gap.

former; this means (usually) a lower power factor.

A gap constructed on this plan is especially advantageous when high powers are to be used in connection with small antennæ. The production of a given antenna current depends on the equivalent resistance of the antenna, its electrostatic capacity and the potential to which it is charged. A small antenna must be charged to high potential for larger energy storage, and this means high spark potentials. Then, with single wave radiation and high efficiency at the coupling coil, it is necessary to employ a spark gap having impact excitation characteristics. The gap described shows this property, provided that the individual gaps are kept very short, and that minimum voltage required to bridge the whole gap circuit is employed. This voltage must be high enough, of course, to give a smooth spark tone. On low frequency supply the spark voltage varies throughout the cycle and it is not sufficient to use a voltage which breaks down the gaps only near the peak of the wave. It has been found that condenser capacity and spark frequency are important factors in controlling the spark potential, and when the latter is invariable at the transformer, recourse may be successfully had to its automatic adjustment by varying either the capacity of the condenser or the rate of sparking. A certain adjustment can be found at which the manifestations of impact excitation are most pronounced and it is usually found most advanta-

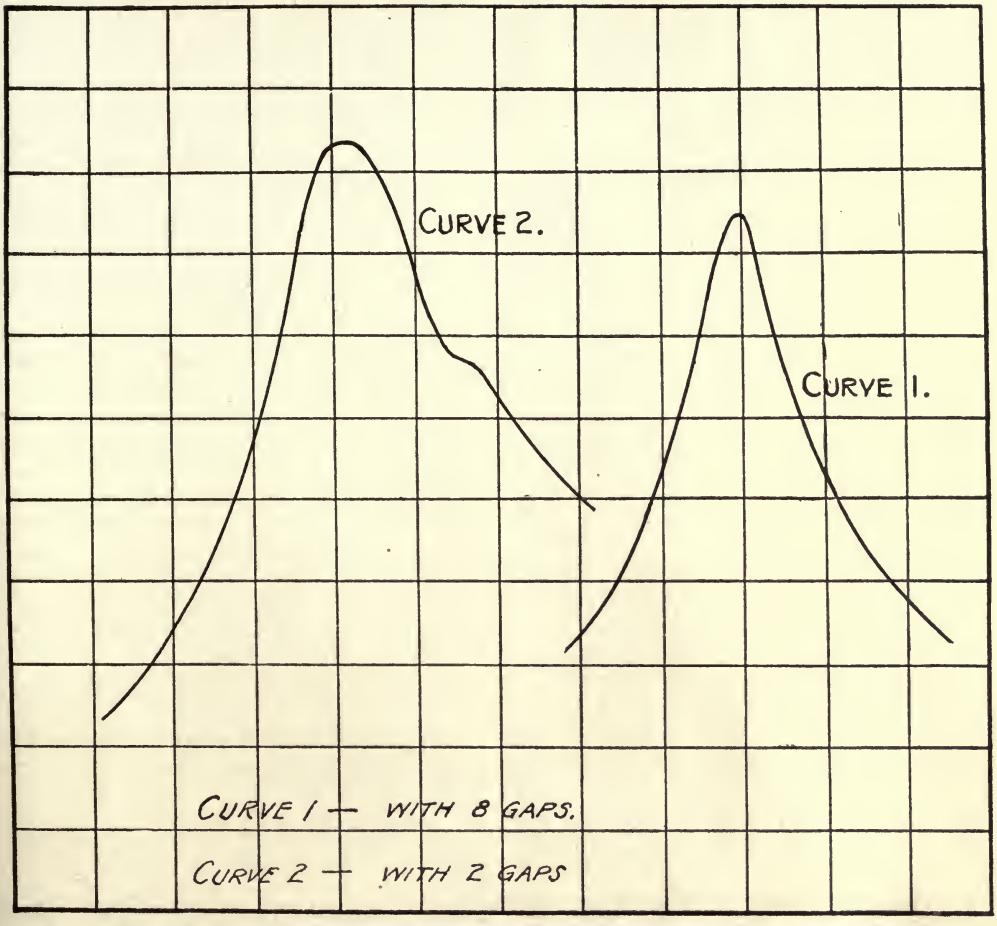


Fig. 6.—Diagrammatic Representation of the Characteristics of the New Spark Gap.

geous to work with this disk speed and condenser.

The first indication that impact excitation is taking place is the tight coupling required for maximum antenna current and also the large drop in this maximum which accompanies the slightest change in coupling from this critical position. The conditions can be more accurately analyzed by loosely coupling a wavemeter circuit to the antenna. The resonance curve (1) of Fig. 6 was taken on an antenna of 0.002 mf. capacity at a wave length of 850 meters with the eight gaps in series. The curve (2) of Fig. 6 was taken under exactly similar conditions, except that only two gaps were used. The wavemeter circuit contained a rotary variable condenser of maximum capacity about 0.004 mf. and an inductance of about 100,000 cms. The self-damping of the wavemeter circuit at the wavelength employed was 0.02. The coupling of the condenser circuit to the antenna was adjusted, in each case, for maximum aerial current. The maximum readings of the ammeter in the wavemeter circuit are not to be compared among themselves as a measure of the energy in the antenna, because the coupling between the wavemeter and the antenna was varied from time to time. As far as the aerial current alone is concerned, the use of the eight gaps gave readings from 20 per cent. to 30 per cent. higher than those obtained with two gaps.

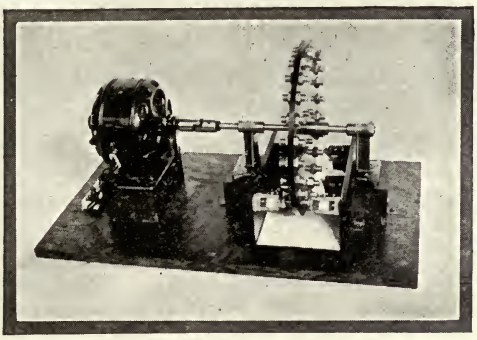
In conclusion, it has been found that this series gap exhibits properties approaching those of impact excitation. This is due, at least in part, to the inherent cooling properties of the rotary gap and to the favorable relation of arc voltage to spark voltage in series gaps. The proper selection of a spark gap alloy is of importance. In this connection zinc is one of the so-called non-arcing metals, and in general its addition to an alloy renders the alloy non-arcing. It has been found, however, that zinc becomes pitted in the electric spark, and hence it is of advantage to alloy it with copper whose tendency to "bead" counteracts the pitting tendency of the zinc, and results in an even wearing of the gap surfaces. The series rotary gap, in the present case, gives an improved power factor on the transformer and an increased overall efficiency into the antenna with lower aerial decrement. The motor speed was invariable in these experiments; it is believed that a higher speed than that used will magnify the advantages of the gap, and experiments to verify this are contemplated for the near future.

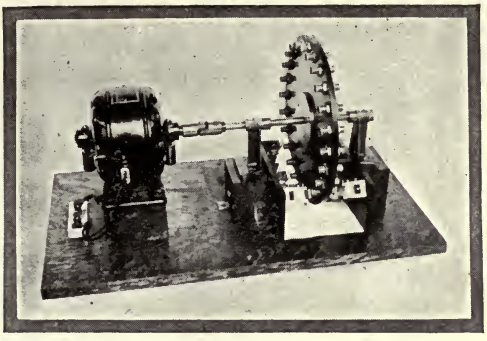
CENTRAL RADIO ASSOCIATION BLUE BOOK

The Blue Book published by the Central Radio Association is now ready for distribution. Not only does this book contain a list of stations of all the members of the association, which covers nearly thirty states, but it also contains numerous wireless facts. The sending power, make of coil or transformer, transmitting distance and other interesting data of every station listed, is also included. In addition to the list of members the call letters of several hundred amateurs who hold a Government license, but who have not yet joined the association, are given.

The Blue Book contains a full explanation of the Government time signals and weather forecast code, an illustrated article on the construction and operation of the audion detector and amplifier, a list of all the principal land and naval stations and their call letters, the abbreviations authorized by the International Radio Telegraphic Convention, as well as a list of abbreviations in general use. A page has been devoted to a key to the call stations of the world, enabling an operator to locate the origin of any unknown official call. In addition to these features there are a number of articles of general interest to the members of the association.

A copy of the Blue Book will be mailed to any one upon the receipt of fifty cents. Correspondence should be





Figs. 3 and 3a.—Two Views of the New Rotary Spark Gap Which Has a Total of Eight Separate Gaps Connected in Series.

addressed to H. B. Williams, Secretary of the Central Radio Association, Chanute, Kansas.

A TRANSMITTING RECORD DUE TO FREAK CONDITIONS

A few days ago the writer received a letter from H. Danner, a wireless amateur in Wilkes-Barre, Pa., who claims he and several others heard my transmitting set in Boston. Any radio expert will certainly state that it is impossible to cover that distance with the power employed except by freak conditions. That the distance covered was remarkable is evident from the fact that under normal conditions my set will not carry more than ten miles.

The feat mentioned will probably not be repeated again, yet it indicates the remarkable carrying powers of even a small transmitting set under abnormal conditions. Although the writer has spent more than two years on board ship where freak conditions have not been uncommon, yet this was his first encounter with an amateur station record.—Francis C. Justice.

MEETING OF RADIO CLUB

The last meeting of The Radio Club of America before the summer holidays was held on Saturday evening, May 29th, 1915, in Room 301, Fayerweather Hall, Columbia University.

Dr. Alfred N. Goldsmith, of the College of the City of New York, presented a most interesting and instructive paper on "Foreign Radio Apparatus." The paper was plentifully illustrated by lantern slides. The Telefunken, Goldschmidt, Lorenz and Poulsen, Berliner Poulsen, and Compagnie Generale Radiotelegraphique systems' apparatus were shown and discussed. Mr. R. H. Marriott, Dr. Zenneck, Dr. Wheeler of the Crocker-Wheeler Co., Dr. Goldhorn, Mr. P. F. Godley, and others participated in the discussion regarding the paper.

A SUGGESTION FOR INCREASING RECEIVING RADIUS

In talking with an old operator recently, the writer was told that if a variable inductance is shunted across the primary of a transformer, the incoming signals are increased about 25 per cent. On putting this suggestion to a test it was found to work extremely well, bringing in signals that were formerly barely audible to a readable loudness.

Almost any sized single-slide tuner may be used as the inductance; in the instance of the writer a 130-meter tuner was employed. The tuner is an excellent substitute for a variable condenser, and the suggestion will therefore be of particular interest to amateurs who are not so fortunate as to possess those instruments.—Howard S. Pyle, L. R. O.

A Memorial Fountain to Wireless Operators

By J. Andrew White

A MEMORIAL fountain to the wireless operators lost at sea now rears its noble column where the tip end of New York looks out toward the remorseless ocean. Standing at the lower end of Battery Park, in the shadow of the Barge Office walls, against a background of stately poplars, this simple and beautiful testimonial to those who have gone to death in the sanctified cause of manliness and self-sacrifice stirs the imagination of the passer-by as no other memorial of uncompromising granite could. It is an eloquent reminder of a tradition that has grown out of the brand of courage which seeks no precedent, which, founded on the heroic action of a mere boy, has been written in the indelible annals of the men who go down to the sea in ships.

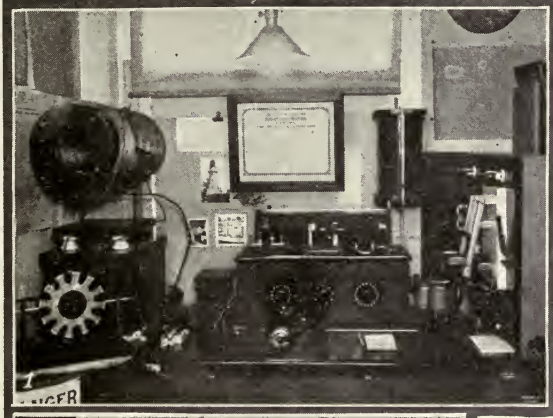
"Most of us are creatures of the land, and the dangers of the sea have in our minds the added terror that attaches to things unknown and mysterious," said Acting Mayor McAneny at the unveiling on May 12th. "So it is that the picture we form of a man on a sinking vessel, sitting calmly at his post and ticking off the calls for help—calls which may or may not be answered—stirs our deepest admiration. Could any sort of courage and sacrifice be more impressive than that of Jack Philips and the coolness with which he stuck to his post on the *Titanic* on that awful Spring morning in mid-Atlantic, three years ago? It was a story that went around the world, and won the respect and gratitude of millions."

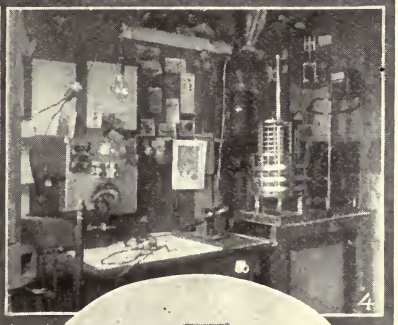
It was remarked that, as in the case of Captains, these young men quit their posts only when their ships have gone down, that they have accepted the tradition of their class or rank. And that is the most beautiful thought of the records of the wireless men. There was no such tradition five years ago, no such unwritten obligation. It remained for a little fellow whose name appears inconspicuously on the shaft, Stephen S. Sczpanck, to blaze the trail which so many have unselfishly followed. Sczpanck was lost on *Car Ferry No.* 18 on September 9, 1910, on Lake Michigan. A long train filled with passengers was being ferried from Ludington, Mich., to Milwaukee, and two-thirds of the distance of a little over one hundred miles had been covered when the boat received her death blow, filling rapidly and settling in the waters with scarcely a ripple. On order from the captain Sczpanck sent out a call for help while the crew summoned to the deck the passengers, who were still comfortably seated in the railroad coaches. The decks were awash before the human freight had sought the safety of the lifeboats. Great excitement reigned. In the midst of the confusion the cool and collected wireless operator appeared, making his way slowly through the aisles and stopping at each seat to reassure the passengers. Help was coming, his wireless appeal had been answered and a sister ship was speeding to the rescue. When the boats had been lowered away in good order and his assistance was no longer needed on deck, Sczpanck returned to the wireless room. There he remained by his crackling key, directing the speeding rescue ships until the still waters closed relentlessly over the vessel he had served so well.

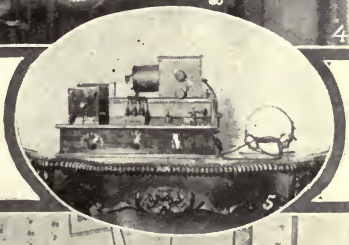
With this noble example of quiet devotion to duty before him, George Eccles, whose name appears among the nine inscribed on the memorial, stood steadfastly by his wireless instruments while his ship, the *Ohio,* pounded to pieces on an Alaskan reef on August 26, 1911. In thirty minutes from the time she struck, the great vessel, which had been carrying two hundred passengers, had slipped from the reef and sunk in the hungry maw of the sea. From the first it had been known that the ship was doomed and the crew worked frantically to get the passengers off in the lifeboats. Ec-

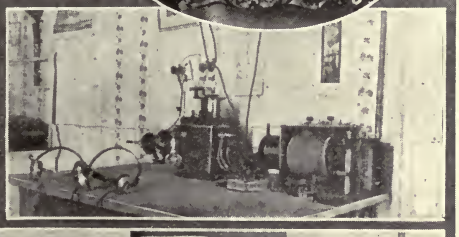
(Continued over leaf.)

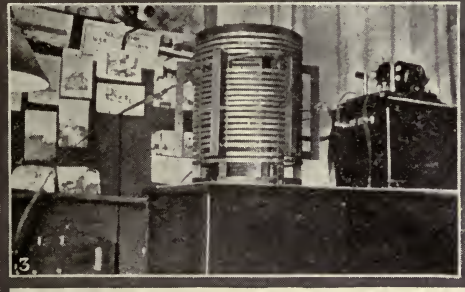
AMATEUR WIRELESS STATIONS

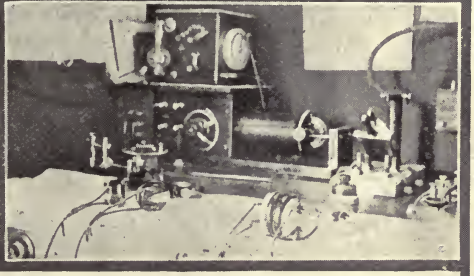












The Wireless Stations Appearing in the Above Views Are: (1) Receiving and Transmitting Apparatus of Milton Baylies, of New Bedford, Mass.; the Greater Part of the Station Has Been Made by Its Owner. (2) Wireless Station of Edward H. Lewis, New York City; the Apparatus Is Mounted in a Neat Cabinet. (3) and (7) Transmitting and Receiving Apparatus of John J. Grossman, Tiffin, Ohio; the One KW. Transmitter Recently Made a Record by Sending a Message Over 920 Miles. (4) Wireless Station of Edmund H. Bremer, of Detroit, Mich.; the Transmitter Has a Capacity of 3 KW., Although but One KW. Is Normally Used. (5) Receiving Set of Jos. L. Turre, Denver, Colo.; It Has a Range of 3,000 Miles. (6) Receiving and Transmitting Apparatus of Orton S. Barnes, of Binghamton, N. Y.

cles' wild, despairing calls crashed out again and again over the angry waters. Not a ship answered. Then, far across the great land and water wastes, came the cheery call of an Alaskan station. It had his message but could not send him direct aid; the voice of its powerful spark, however, would be lifted in an added appeal for succor. The minutes passed, the time was growing short. Tense, straining every faculty for a sound in his head telephones, the faithful operator scorned the death that crept toward him in the rising sea. Suddenly the far-away land station called again; it had picked up two vessels near by, the *Humboldt* and the *Rupert City,* and they were then headed for the *Ohio.* Eccles told the captain, and then turned to the task of sending messages to the approaching ships, directing them to his exact position.

Twenty minutes after the ill-starred vessel struck, the waters flooded the engine room and silenced his instruments. He arose then and stood out on the deck, watching the last of the departing lifeboats. One of the relief vessels hove into view and a great cry of exultation came from the throats of harassed passengers. It seemed certain that all would be saved. Just at that moment a vicious comber swept down on the staggering *Ohio,* lifted her high off her precarious position and crashed her down on the cruel rocks. In an instant she was gone, and with her the man who had saved her helpless humans in the face of tremendous odds.

Conspicuous on the face of the shaft is the name of Jack Philips, the martyr to duty in the great *Titanic* disaster of April 15, 1912. His bravery, coolness and skill in time of immortal stress bring uplifting memories to a still shuddering public. To the very magnitude of that great ocean tragedy in which he figured is due the recognition of the wireless operating fraternity for which the monument stands—the one lasting memorial this country has raised to them. It was the shock of horror which then reverberated around the world that awakened a grateful humanity to a sense of obligation and started the flow of contributions which soon afterward assumed proportions sufficient to defray the expense of erecting the memorial. William Lawrence Bottomley, of the firm of Hewitt & Bottomley, architects, voluntarily offered his services and furnished gratuitously the design which was selected after a competition; the Marconi Company contributed five hundred dollars as a nucleus and passengers on coastwise vessels willingly subscribed the balance of the fund in smaller amounts. No intensive solicitation was made, no propaganda prepared to aid the raising of the desired sum; as the principal speaker at the unveiling remarked, it was a direct refutation of the contention that "in the rush of our affairs we are all too prone to forget great deeds."

To the Philips brand of courage, then, must be attributed this monument from the people. A more noble example of the heights young men can rise to in meeting an emergency will never be known. On the night of the disaster he was tired out after a long vigil in the wireless room. He had worked uninterruptedly for seven hours the preceding day, effecting some needed repairs. Under the regular routine he was not due off watch until midnight, but his assistant, Harold Bride, appreciating the strain of the overtime labor, had insisted upon relieving him earlier in the evening. Thus it was that Bride was standing beside when the ship hit the iceberg. Refusing to give up his post, Philips continued at the key from the time the first SOS call was sent until his instruments no longer would work. He had established communication with the *Carpathia* and other vessels, had given them the ship's position and received assurance of speedy rescue; his captain had told him: "You have done your duty. You are free now; every man for himself in a time like this!" But Philips stayed. Refusing even to stop for an instant to adjust a life preserver, he bent resolutely over the little rubber knob that spelled salvation to the helpless passengers and continued sending out reports that would aid in picking up the laden lifeboats.

Only when the last flickering sputter had come from his key did he give a thought to himself. The lifeboats had long since gone, and, fearless and calm,

he stood on deck until the great leviathan took her final plunge into the icy waters.

When dawn arrived, and with it the *Carpathia* on her mission of rescue, his lifeless body was tenderly lifted from a crowded life raft.

Among the six heroes whose gallant deaths are commemorated as occurring on the Pacific Ocean, the first name is that of Lawrence A. Prudhunt, who perished in the wreck of the *Rosecrans* on January 7, 1913. Little is known of Prudhunt's faithfulness to trust, for his was not a great passenger ship, laden with important people. Only thirty-six members of the crew were aboard and but three were saved. The vessel struck a rock and sunk soon afterward. He was offered a chance in the boats which the crew were putting over the side, but went instead to the wireless room and continued directing the rescuers until the ship broke up beneath him. When assistance came it was found that he had been pinned under the wreckage and washed overboard when the wireless house was swept into the hungry waves.

The Memorial Fountain to Wireless Operators, and an Impressive Moment in the Dedication Exercises.

In the wireless room also, with all avenues of escape cut off by wreckage, Donald Campbell Perkins perished on August 18, 1913. His ship was the *State of California,* which sank in Gambier Bay, Alaska, three minutes after she had ripped her bottom off on an uncharted rock. But even in the short time before the mountainous deluge swept through her, Perkins had rushed from his cabin in his pajamas, taken charge of the wireless apparatus, and given his distress call and position to the Alaskan steamship *Jefferson.* That vessel chanced to be near by and arrived on the scene a few hours later; it was broad daylight and no difficulty was experienced in picking up the many passengers whom the crew had succeeded in placing in the lifeboats. Thirty-one were missing, trapped in their staterooms, and among them was the faithful operator. His assistant was saved, and it was he who told how Perkins had ordered him to go on deck and assist in the launching of the small boats. There was one lifeboat immediately in front of the wireless cabin which they were unable to launch. As the vessel took a sudden list to port this boat broke adrift and jammed fast in the door, making Perkins a prisoner. Realizing fully that every second counted if he was to make his escape, the young man elected to stand by his key and give further directions to the summoned rescue vessel.

Just twenty years old was Ferdinand J. Kuehn when he gave up his life for another, when, on January 30, 1914, the *Monroe* sank off the Virginia coast. This heavily laden passenger vessel met in collision with a freighter as she was feeling her way through a dense fog. It was known instantly that the vessel had received her death blow and Kuehn's assistant brought a life preserver to the wireless room, adjusting it as the wireless instruments again and again crashed forth the SOS. Only twelve minutes elapsed between the time the vessel was struck and when she sank. The crew had succeeded in getting three boats away when the wireless operator appeared on deck, his work done. Just then one

of the women passengers passed; she had no life preserver. Kuehn insisted that she take his. He adjusted it for her and helped her into a lifeboat. This boat was among the last ones to get away, and a few minutes later the survivors it carried saw the young operator slip on the tilted deck and fall into the water. With the life preserver to keep him afloat he would have been saved. Willingly, he had sacrificed his life that another might live.

Kuehn was a popular boy in New York and a graduate of the Bronx High School. Many of his former companions looked on as the sailors blew "taps" over the shaft which bears his name. In the silent crowd, too, were a number of his later friends of the sea; for in deference to the occasion the Marconi offices closed at noon, enabling all Kuehn's fellow workers to be present at the unveiling.

Chiseled on the shaft of honor close beside this record of a brief career is the name of Walter E. Reker, another twenty-year-old boy, lost in the wreck of the *Admiral Sampson* off Seattle, Wash., on April 25, 1914. These two disasters, occurring less than three months apart, had several similar features. The *Sampson* received her death blow in a collision and sank in fog-bound waters soon after. An added horror in this case was brought on by the cargo of oil igniting and enveloping the ship in a sheet of flame. Reker sent out his appeal for aid and stood by his post of duty until the vessel which had dealt the fatal blow advised him by wireless that she was sending for assistance and there was no need for him to operate his instruments any longer. The time was growing short, but the wireless operator refused to abandon the ship, taking his place instead beside the crew and assisting the passengers into the boats. Ignoring repeated appeals to save himself, he waited until the last boat had left and all but two of the fifty-four passengers had gone to safety. Then he reported to the bridge and sank with the ship to his death, standing beside his captain.

Two names complete the record on the fountain shaft. Side by side in life, Clifton J. Fleming and Harry F. Otto are immortally paired in the inscription which relates their heroism when the steam schooner *Francis H. Leggett* filled and sank in the Pacific, sixty miles south of the mouth of the Columbia River. This was on September 19, 1914. For two days she had been pounded unmercifully by the heavy seas and finally a particularly vicious wave tore loose a hatch and a torrent of water poured into the hold. Fleming sent out the distress call as the vessel began to list and two steamships started to the rescue. Efforts to launch the lifeboats proved futile; as soon as they struck the water they capsized. Suddenly the vessel lurched as her lumber cargo shifted, and she disappeared beneath the waves. Otto, the junior operator, was carried down by the suction. Fleming clung to a piece of wreckage and gave aid to those struggling in the water about him. One of the survivors later told how this seventeen-year-old boy pulled him to safety and then grasped a floating railroad tie for his own preservation. Just then a woman lost hold of the wreckage which was keeping her afloat and was washed against Fleming. He reached out for her and helped her to the tie which he was gripping, and then, realizing that it would not support the weight of both, let go and sank.

Simple and supreme courage in time of peril, faithful devotion to duty in the face of tremendous odds and a brave unselfishness that causes all men to experience a thrill of pride and an elevation of spirit, is the story the nine inscriptions on this newest monument tell to humanity. New York and the country at large will specially reverence this beautiful memorial, erected at a time of strife and combat so at variance with the spirit of its conception. For it typifies those qualities so essential to the world in the great period of reconstruction which is to follow the dawn of peace, the qualities which, by the strange coincidence of words, make possible—shall we say it?
—THE WORLD'S ADVANCE.

The August issue will contain many feature articles in the Radio Section. Don't fail to read them.

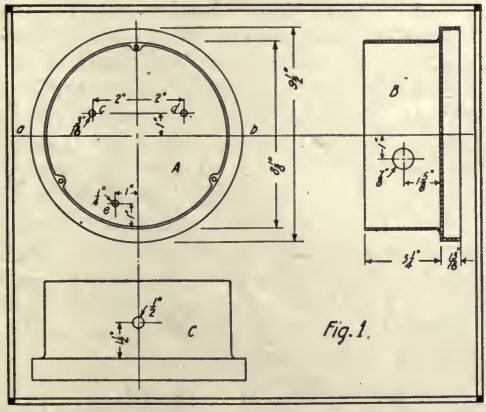
A Hot Wire Meter of Simple Design

By C. L. Sears

IN the construction of the average hot wire meter there are some parts which could be simplified. For instance, the device used to bring the pointer back to zero is usually in the nature of an arrangement whereby the wire is tightened or loosened, as the case may be. This construction usually involves a special casting which in itself sounds formidable to the amateur.

The meter to be described is provided with an adjusting member which is easily made and which gives a wide range of adjustment. The case of the meter made by the writer was taken from a damaged voltmeter of the switchboard type and of the size indicated in the dimensioned drawing, Fig. 1. While these meter cases are not difficult to obtain, the movement of the hot wire meter could just as well be mounted in a neat wooden case.

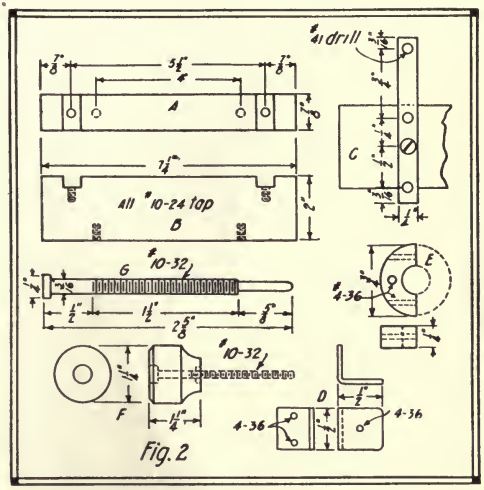
In laying out the case prior to drilling the holes, the builder will facilitate his work if he scribes two diametrical lines at right angles to each other across the back of the case on the inside. With reference to Fig. 1, scribe a second line



The Details of the Case for the Hot Wire Meter.

one inch above the center line and drill two 3-16-inch holes on this line 4 inches apart or, in other words, 2 inches on either side of the vertical center line. This layout is indicated at *C D* in Fig. 1. These holes are to hold the fibre support for the wire.

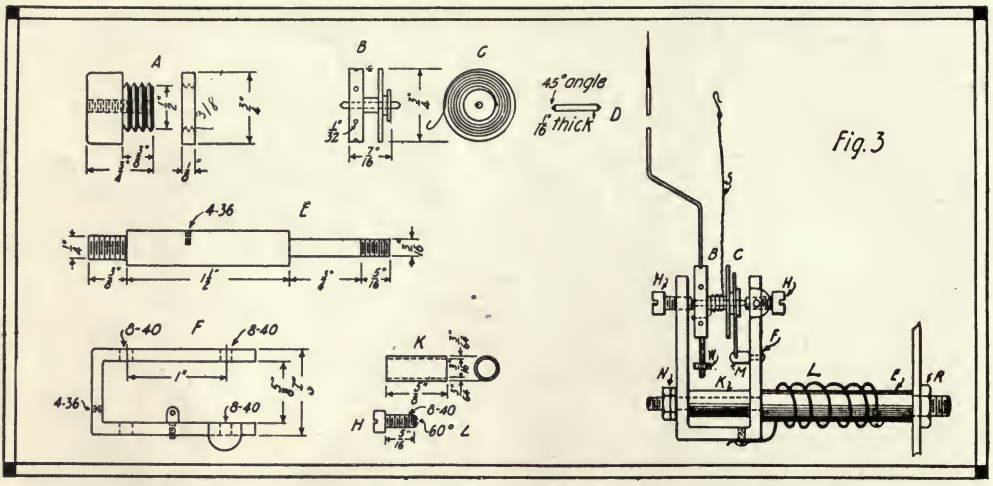
Measuring one inch from the inside



Various Parts of the Hot Wire Meter.

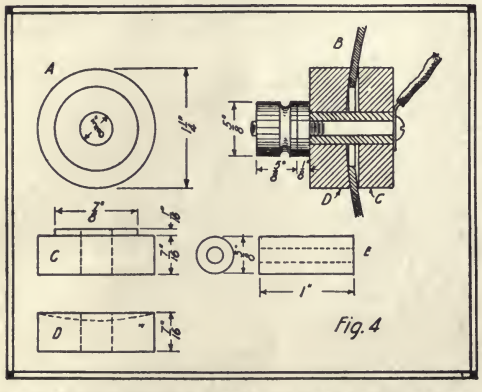
of the case and one inch to the left of the vertical line, drill a ¼-inch hole, *E*, Fig. 1. In the sides of the case drill two ⅞-inch holes for the insulating bushings and also a ½-inch hole for the brass adjusting screw bushing as shown at *C* Fig. 1. The insulating support for the wire holders is made from a piece of black fibre ⅞x2x7¼ inches and is drilled and tapped as shown at *A* and *B*, Fig. 2. As shown in the drawing, it is slotted ⅛ inch deep and ¼ inch wide. At *C* are shown the two wire supports which are made from ¼-inch square brass stock 1⅞ inches long. The three small holes ¾ inch apart on centers are drilled and tapped 4-36 and the large 3/16-inch hole is drilled to clear a 10-24 round head machine screw to fasten the supports to the fibre crosspiece. The small holes should each be supplied with screws and small washers.

At *D* and *E* are shown the dial supports for a case of this type. Two of



Different Members of the Hot Wire Ammeter Movement, as Well as a Side View of the Movement When Assembled.

the styles shown at *D* and one similar to that shown at *E* are required. The two *D* pieces are made from ½x1/16-inch brass strip drilled and tapped as shown, while the piece *E* is made from a ¼-inch piece of ¾-inch diameter round brass rod. The details of the fibre knob for the adjusting screw are



Details of the Binding Posts and Insulated Bushings.

shown at *F*, while the adjusting screw is illustrated at *G*.

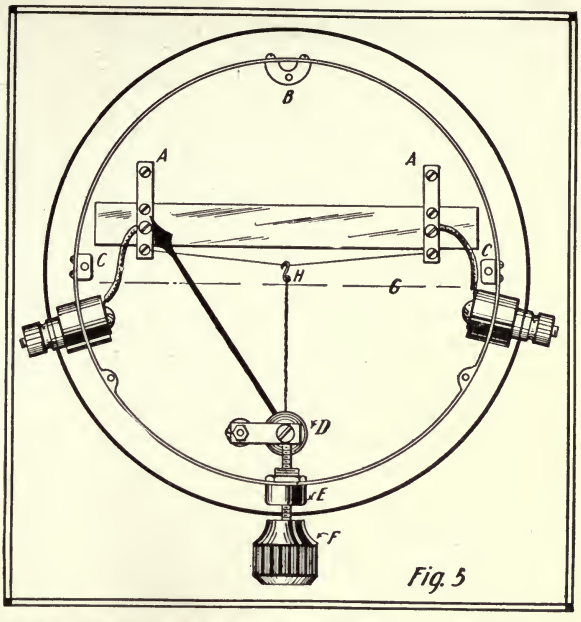
In Fig. 3 the reader will find the details of the movement. The part *B*, which holds the pointer, is made from a piece of ¾-inch rod which is turned to the shape indicated in the drawing. The pointer is fitted into a radial hole on one side while a small counter weight *W* is fitted in the opposite side. The spiral hair spring which carries the pointer across the scale is made from a piece of thin phosphor bronze sheet, or, if the builder happens to have one handy, he may employ the steel hair spring from an old alarm clock. The spring should be very light and it should be put on counter clock-wise. The steel center or pivot *D* is made from a piece of 1/16-inch drill rod or a phonograph needle pointed on each end and hardened.

The main support shown at *E* is made from a piece of ⅜-inch round brass turned-down and threaded as shown. The small hole is to take a screw which fastens the end of a spring used to rotate the entire movement clock-wise. The piece which holds the movement *F* is made from a piece of brass bar, drilled and bent as shown in the illustration. On the lower arm of this piece there should be fastened a small piece of brass upon which the adjusting screw may bear. The addition of a small projection *M* to which the end of the spiral spring is attached completes the holder for the movement. The assembly of the movement is shown in Fig. 3 in the completed view. After the movement has been assembled, the balancing weight *W* should be adjusted until the pointer will rest at a given point regardless of the position of the meter case.

The hot wire for an instrument to be used in connection with a 1 K. W. outfit

should be a No. 30 bare copper wire, as this will give a full scale reading at 7.5 amperes. The extra holes in each wire holder are to permit of the connection of shunts. The shunt, if it is found necessary, is to consist of single wires of the same size, resistance and length as the wire measured. Connections may be made from a short piece of flexible lamp cord with terminals or from a piece of copper strip.

For calibration of this meter, it is advisable to use a direct current supplied by a storage battery or a number of dry cells connected in multiple. The hot wire meter should be connected in series with a standard direct current instrument and a rheostat capable of being adjusted in steps of ¼ ampere at a time. In marking the scale, the greatest care should be taken to avoid drafts, as even one's breath on the heated wire will cool it sufficiently to falsify the results.



Front View of the Working Parts of the Hot Wire Meter as It Appears When Finished.

This meter will read with equal accuracy on either alternating or direct current, and its reading on high frequency current will be the same. The only precaution in connection with its use is to make sure that the meter is not overloaded, as in such an event the wire would quite likely stretch seriously or else burn in two. This would, of course, necessitate replacing the wire and recalibrating the instrument, involving a great deal of extra work.

A GOOD STRAIN INSULATOR

Owners of wireless stations always have to make use of insulators in their aerials. Porcelain cleats are generally employed for this purpose, but are found to be useless when they are subjected to any strain such as guy-wires impose upon them. The writer has found that a block of wood with an outer coating of paraffine is an excellent insulator and, moreover, possesses a high tensile strength. The block is dipped in the melted wax and thoroughly impregnated. Wood is naturally a good insulator but has the disadvantage of partially conducting an electric current when it is wet, and thus allows considerable leakage in the case of wireless. The paraffine renders the block waterproof, and therefore makes a good strain insulator.—H. C. Loomis.

ELIMINATION OF TEST BUZZER NOISE

The noise made by the test buzzer may be reduced to a minimum by suspending the buzzer from the table edge by means of rubber bands. Furthermore, the connecting wires running from the table to the buzzer are curled. When the instrument is screwed directly to the table, as is usually the case, the table top acts as a sounding board, greatly augmenting the actual sound produced by the buzzer. The same is the case when the buzzer is screwed to a wall.—Royal Bergvall.

Long Distance Wireless Telegraphy*

By J. B. Woolsey

THE casual "listener-in" on a long distance radio set at the present date is apt to be impressed with the fact that the use of undamped oscillations for long distance radio telegraphy may soon become more or less universal. While it is true that no definite decision has been arrived at as to the relative merits or demerits of the damped and undamped systems, still, the general trend of practice seems to be toward the latter. This is probably augmented by the fact that there has been developed of late a certain type of receiving apparatus peculiarly suited to the reception of undamped oscillations, giving at the same time extreme sensitivity.

There are a number of long distance radio telegraphic circuits used more or less commercially, but largely experimentally, concerning which the general amateur field is not at all informed. One of the most successful of these is that of the Marconi Company between Glace Bay, Nova Scotia (WSS), and Clifden, Ireland (MFT). These stations work twenty-four hours per day with practically no interruptions, handling an enormous volume of commercial and war traffic. The dispatch of traffic at these stations is facilitated by the fact that the circuit is duplex, allowing the operators to interrupt each other during the transmission of a message, permitting the immediate correction of an error. These stations, although fitted with spark gaps of the rotary type, produce oscillations of feeble damping which possess characteristics similar to the stations employing genuine undamped oscillations.

There are five methods in use to-day for the generation of undamped oscillations, viz. (1) the Poulsen arc; (2) the Goldschmidt high-frequency alternator; (3) the high-speed, high-frequency alternator; (4) the Count Arco step-up transformer system for the generation of undamped oscillations; (5) the General Electric Kenotron.

The Poulsen arc does not, as is generally supposed, generate pure undamped oscillations; as a matter of fact these oscillations are produced in a series of groups, the groups taking place at a rate above the limits of audibility. Due to slight irregularities in the action of the arc, this type of transmitter possesses slightly damped characteristics, so much so, in fact, that the signals may often be read on the ordinary crystalline detector at a distance of 10 to 50 miles from the station.

The arc system is employed exclusively by the Federal Telegraph Company of San Francisco, Cal. The company operates a few long distance stations at various points. The arcs at these stations are employed in a simple manner; one of the electrodes being connected direct to the earth and the other to the aerial system. The wave length of the antenna system is then increased or decreased as desired by the simple addition or subtraction of the turns of a tuning inductance connected in series with the aerial circuit. Signalling is accomplished by short-circuiting a few turns of this inductance with an ordinary transmitting key.

Thus, the aerial system is rapidly changed from one wave length to another, and if the distant transmitting station is tuned to the wave emitted when the wave is depressed, the wave emitted when the key is raised will be inaudible. The arc at these stations is enclosed in a chamber and supplied with either hydrogen or ordinary illuminating gas or perhaps alcoholic vapor. It is likewise burned in a strong magnetic field at right angles, which increases the steadiness of the arc and its effectiveness as a whole.

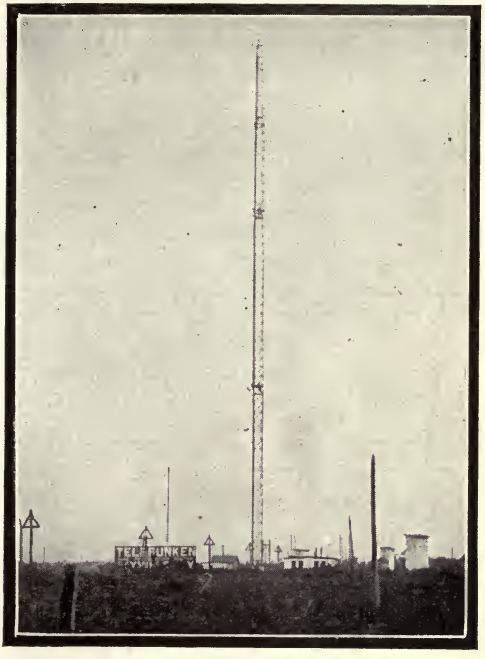
The receiving apparatus at these arc stations generally consists of a sliding wire tikker which comprises a simple piece of flexible wire in loose contact with a rotating wheel. It is connected in

*Owing to the inordinate length of this article, it has been found necessary to publish it in two parts. The second and concluding part will appear in the August issue. (Photos. International News Service.)

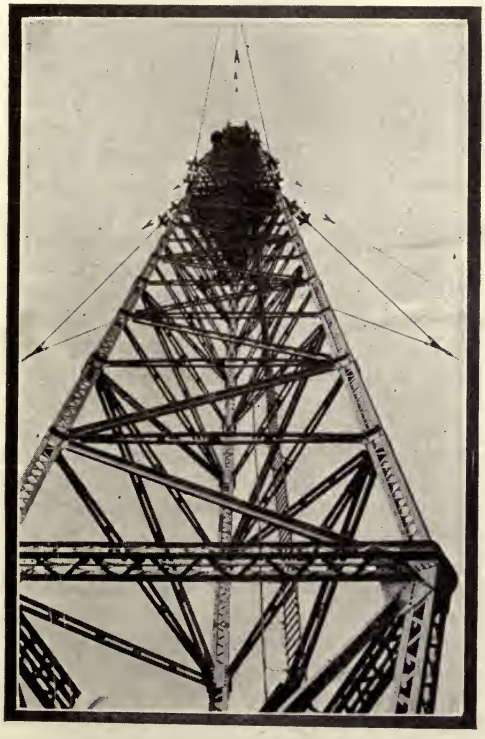
the circuit in a manner similar to the ordinary detector.

The Federal Company operates several commercial stations on the Pacific coast, the most prominent one being the "KSS," South San Francisco, Cal., station, and a similar station located at Heeia Point, Honolulu, Hawaii. The San Francisco station operates on a wave length of 7000 meters and actually consumes from 50 to 60 K. W. of direct current energy. The corresponding station at Honolulu often operates on a longer wave length—sometimes at 11,000 meters—and is particularly effective. Commercial correspondence is carried on between these two stations with a fair degree of accuracy. An interesting feature in connection with the South San Francisco station is that the use of a fan aerial has been abandoned and a large single cable substituted for it.

Another long distance radio circuit in daily use is that employing the Goldschmidt system between Tuckerton, N. J. (WGG) and Eilvese, Germany (OUT).



The Steel Mast of the Sayville Wireless Station on Long Island.



Looking Toward the Top of the Steel Tower at the Tuckerton Wireless Station.

These stations employ the Goldschmidt high-frequency alternator, which is a generator giving a very high frequency at a low initial speed. The alternator at Tuckerton is of about 70 K. W. capacity and operates at a frequency of about 50,000 cycles. The station at Eilvese is said to employ an alternator of 150 K. W. capacity at a similar frequency.

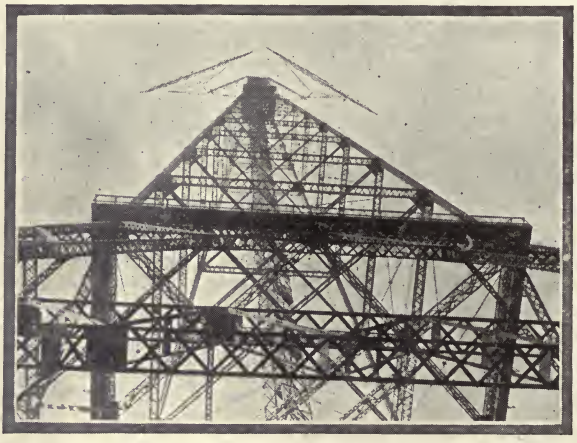
Immediately after the outbreak of the European war the Tuckerton station was taken over by the United States Government and operated on a commercial basis in connection with the corresponding station at Eilvese. The staff at the station at present consists of ten operators, in charge of a naval lieutenant. Commercial business is accepted for points in Germany, subject to a delay, at a rate of 50 cents per word. Since the opening of this service the Tuckerton station has been congested with traffic and, owing to its limited facilities for handling the same, has often fallen several days behind.

During the most favorable months of the year, these two stations were able to carry on correspondence throughout the twenty-four hours of the day, but only

with fair degree of accuracy during specified hours. In fact, at the present time, these two stations are only in communication between 5 p. m., Eastern Standard Time, and 2:30 a. m., Eastern Standard Time, which are, of course, the more favorable hours during the day for long-distance radio telegraphic communication in this portion of the universe.

The traffic from the Tuckerton station is sent in series of groups of messages which are acknowledged at the Eilvese station at the end of each group. The Eilvese station then replies, requesting repetitions of lost words, which is followed by the dispatch of traffic that has meanwhile accumulated at Eilvese.

The service between these two stations is handled in an accurate manner, but at a slow speed, consequently only a limited amount of business can be handled.



Looking Toward the Top of the Tallest Steel Mast of the Arlington Station.

As mentioned before, the Goldschmidt high-frequency alternator is unique in that a very high frequency is obtained from a low initial generator speed of about 3,000 revolutions per minute. The generator itself comprises a stator and rotor, the stator being magnetized by a direct current source of supply. The number of field poles and the design of the rotor are such that the initial frequency of the machine is 15,000 cycles per second. The rotor is then shunted by coils of inductance and a condenser constituting an oscillatory circuit, which has a natural frequency of 15,000 cycles per second. Due to the rotating magnetic field produced, the rotor induces currents in the stator having a frequency of just double the value, viz., 30,000 cycles per second. The rotation of the rotor in the magnetic field produced by the 30,000 cycles in the stator induces in it (the rotor) currents at a frequency of 45,000 cycles per second. A second circuit is now joined across the rotor, which has a natural frequency of 45,000 cycles and the reaction of this magnetic field on the stator produces in it a frequency of 60,000 cycles per second. The terminals of the stator are in turn connected to the aerial and earth connections, the aerial being so adjusted by tuning inductances to give it a natural frequency of 60,000 cycles. In other words, the antenna and earth connections are joined across the original direct current field magnets, which also have alternating currents of high frequency flowing through them. The antenna is in turn attuned to the high-frequency energy.

Signalling is accomplished by the insertion of a telegraph key in the direct current circuit to the field coils, the field windings being thus magnetized and demagnetized to produce the dots and dashes of the telegraph code. The high-frequency alternating current super-imposed upon the direct current circuit is prevented from flowing back into that circuit by specially designed choke coils.

It is extremely important that the speed of a high-frequency alternator be maintained constant in order to keep the aerial in resonance. Arrangements are therefore made whereby the field of the motor driving the generator is weakened just previous to the pressing of the key. Thus the speed of the generator is kept fairly constant.

A transmitting station of this type is indeed novel, since the customary high potential condensers, noisy spark gap and oscillation transformer are absent. It is rather awesome to see this machine in

operation, because the observer is conscious "that something is doing" in the ether, but there is not the accompanying crash one expects from the ordinary set.

The receiving apparatus in use at Tuckerton comprises the Goldschmidt tone-wheel, which is nothing more than a circuit interrupter breaking the circuit many thousands of times per second. In this manner beats are produced in the local receiving circuits giving a musical note depending upon the rate of interruptions taking place. The signals thus made audible by the tone-wheel are increased in intensity by means of a triple audion amplifier.

It was a master stroke of the Germans to put this Eilvese-Tuckerton route into operation, for they are thus enabled to carry on communication with the outside world while the cables are in charge of the Allies.

RADIO CLUB OF AMERICA'S COMMENDABLE WORK

During the recent visit of the Atlantic Squadron in New York a temporary radio station was maintained at the Hotel Ansonia, the headquarters of Admiral Fletcher and many of his officers, for their use in communicating with the vessels of the fleet. The station was established in Room 168, the headquarters of the United States Navy League, through the courtesy of the Radio Club of America which made the installation and operated the station.

The installation was of a composite non-synchronous 1 K.W. type, power being supplied from a special motor-driven alternator. The station was operated under a special temporary license and was tuned to an unusual degree of sharpness, the decrement being .05. Amplifying apparatus of the audion type rendered received signals audible throughout the operating room, as well as in the adjoining rooms and corridors. The installation and operation of the station was undertaken by the Radio Club under the supervision of Mr. Paul F. Godley, one of the club directors. Mr. Godley was recently in charge of work on Brazilian government stations and is a man of wide experience in radio work. Two operators were in constant attendance. Mr. Godley, together with Messrs. Sadenwater, Lemmon, Grinan and Faraon, handled most of the work.

All communication was with the vessels of the fleet. The station was much used and proved a great convenience to Admiral Fletcher, his officers and families, and the members of the Navy League.

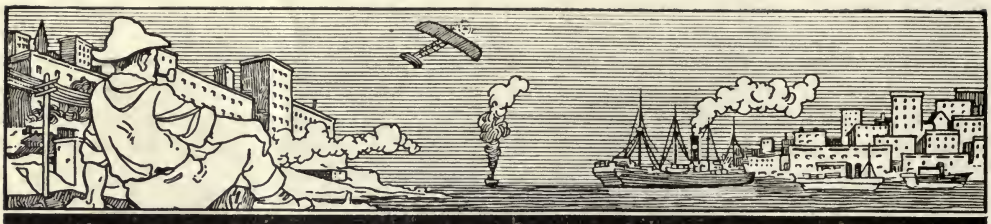
THE ATLANTA RADIO CLUB IS FORMED

It is announced that a wireless society has been formed at Atlanta, Ga., for the purpose of advancing the interests of the wireless amateurs and known as the Atlanta Radio Club.

The following officers have been elected: A. S. Guimaeraes, President; F. Merriam, Vice-President; B. R. Magee, Treasurer, and M. A. Herzog, Secretary.

Communications from amateurs within 100 miles from Atlanta are solicited by the club. Amateurs living beyond that range are also requested to interchange ideas with the members of this society. All correspondence should be addressed to the Secretary, 16 Faith St., Atlanta, Ga.

There has been recently placed in operation at Seattle, Wash., a wireless station for the use of the port warden. The station has been assigned the call letters K P E, after being tested and passed upon by Radio Inspector V. Ford Greaves.

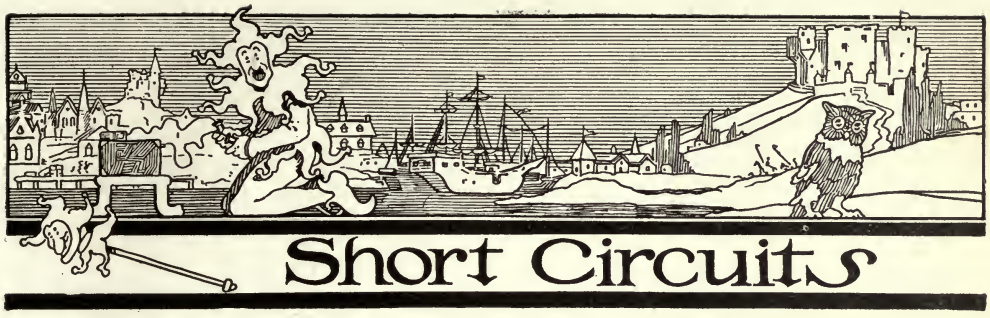


What the World is Doing

MANUAL labor is being seriously threatened by the ever-increasing competition of labor-saving machinery. There is probably no single trade which machinery has not invaded, with the result that work previously accomplished by hand has been dispensed with to a greater or lesser extent, depending largely on how skilled that labor was. Elsewhere in this issue there appears an article entitled "Reducing the Human Element in Modern Printing," in which the work of the linotype and monotype machines is described. Here we have a striking instance of the capabilities of modern machinery. No one will deny that the task of typesetting or composing is one requiring skilled labor. Years past, hand compositors or typesetters were paid fair wages for their work, and many of them employed, because of the necessarily time-consuming nature of their task. Yet today in place of these bright, industrious men will be found intricate machines directed by men or even women operatives. One linotype machine with its operator can easily replace five men, hence four men have been eliminated from typesetting work by the introduction of machinery. And it must not be forgotten that printing is but one of many trades in which similar conditions already exist. Truly, the days of the man who works with his hands only are numbered. At no distant date he must give way to gears, cogs and levers made of steel, brass and other inanimate substances, assembled together in marvelous machines through man's ingenuity. Brains only cannot be replaced by machinery.

TIME was when the wireless operator was considered a nuisance. In the old days he caused more than one commercial and Government operator to employ profane language in voicing his opinion of some one particular amateur, and all of them in general, especially when endeavoring to read a long distance message with a nearby amateur indulging in a friendly conversation with another amateur, or, worse still, holding down his key in order to adjust the spark gap. Conditions are entirely different today. The amateurs, thanks largely to the Government regulations now enforced, have developed into serious experimenters, with their hobby and the interests of others at heart. On more than one recent occasion the amateurs have come to the rescue of Government and commercial wireless operators when both the latter required assistance. A most typical instance of this fraternal co-operation was witnessed a few weeks ago during the visit of the Atlantic Squadron to New York City. The Radio Club of America installed a model radio station in the Hotel Ansonia, the headquarters of Admiral Fletcher and his officers, enabling the visiting Admiral and his staff to communicate with the vessels of the fleet. But the installation of the apparatus did not complete the commendable undertaking. Club members operated the instruments during the entire period of the naval visit and handled no little amount of wireless traffic for the naval officers. The station proved a great convenience to Admiral Fletcher and his officers, and this deed on the part of the Radio Club of America will no doubt serve to bind still closer the tie of friendship between the amateurs and the Government and commercial operators.

WITH a view to properly preparing the United States for any military eventualities, there has been formed the National Security League with headquarters at 31 Pine St., New York City. While the United States of America is undeniably the leading exponent of peace and arbitration, still, according to the spokesmen of the League, so long as other powers of the world decide that international questions had best be settled by recourse to arms it is obviously imperative that we Americans should be prepared not only to defend our coasts against hostile invasion but also to enforce our authority abroad should occasion demand it. It is the purpose of the League to take such steps as will eventually result in placing the United States in a better state of preparedness and with fair assurance always to be able to defend our institutions and principles. Americans desirous of joining in this patriotic work are asked to communicate with the headquarters of the League.



"What do you want with all those hammocks and phonograph records and fancy groceries?" asked the storekeeper. "Going to have summer boarders?"

"No," replied Farmer Corntossel. "I wouldn't waste all them on summer boarders. I'm tryin' to make the place attractive enough to persuade a few farmhands to linger around an' help me out with the wheat crop."—*Kansas City Journal.*

♠

Paying Teller (to woman with check)—"I'm sorry, madam, but you'll have to be identified by some one I know."

"Oh, very well; I have a friend waiting outside in the machine. I'll bring her in and introduce you to her."—*Life.*

♠

He—Yes, the governor cut off my allowance, so I've had to cash my brains for a living.

She—I wondered why you were looking so thin.—*Boston Transcript.*

♠

"You've made a mistake in your paper," said an indignant man, entering the editorial sanctum of a daily paper. "I was one of the competitors at that athletic match yesterday, and you have called me 'the well-known lightweight champion.'"

"Well, aren't you?" inquired the editor?"

"No, I'm nothing of the kind, and it's confoundedly awkward, because I'm a coal merchant!"—*National Monthly.*

"How's business?" inquired the life insurance agent.

"Haven't turned a trick this week," said the book agent.

"Same here. I'll tell you what I'll do."

"What?"

"I'll buy a set of books if you'll take out some insurance."—*Pittsburgh Post.*

♠

Passenger—I'd give you a tip, only I've nothing but a $10 bill.

Porter—Oh, that'll be enough, sir.—*Boston Transcript.*

♠

Motorist—Yes, I advertised for a chauffeur and I have no doubt you are a good one, but I am sorry to say the position is filled.

Applicant—Then, sir, would you mind giving me a reference saying I'm a good chauffeur and you were sorry to lose me?—*Washington Star.*

♠

"I had a dreadful fall last night."

"Tell me of it, Egbert."

"My wife was talking; I hung on every word, and then, and then——"

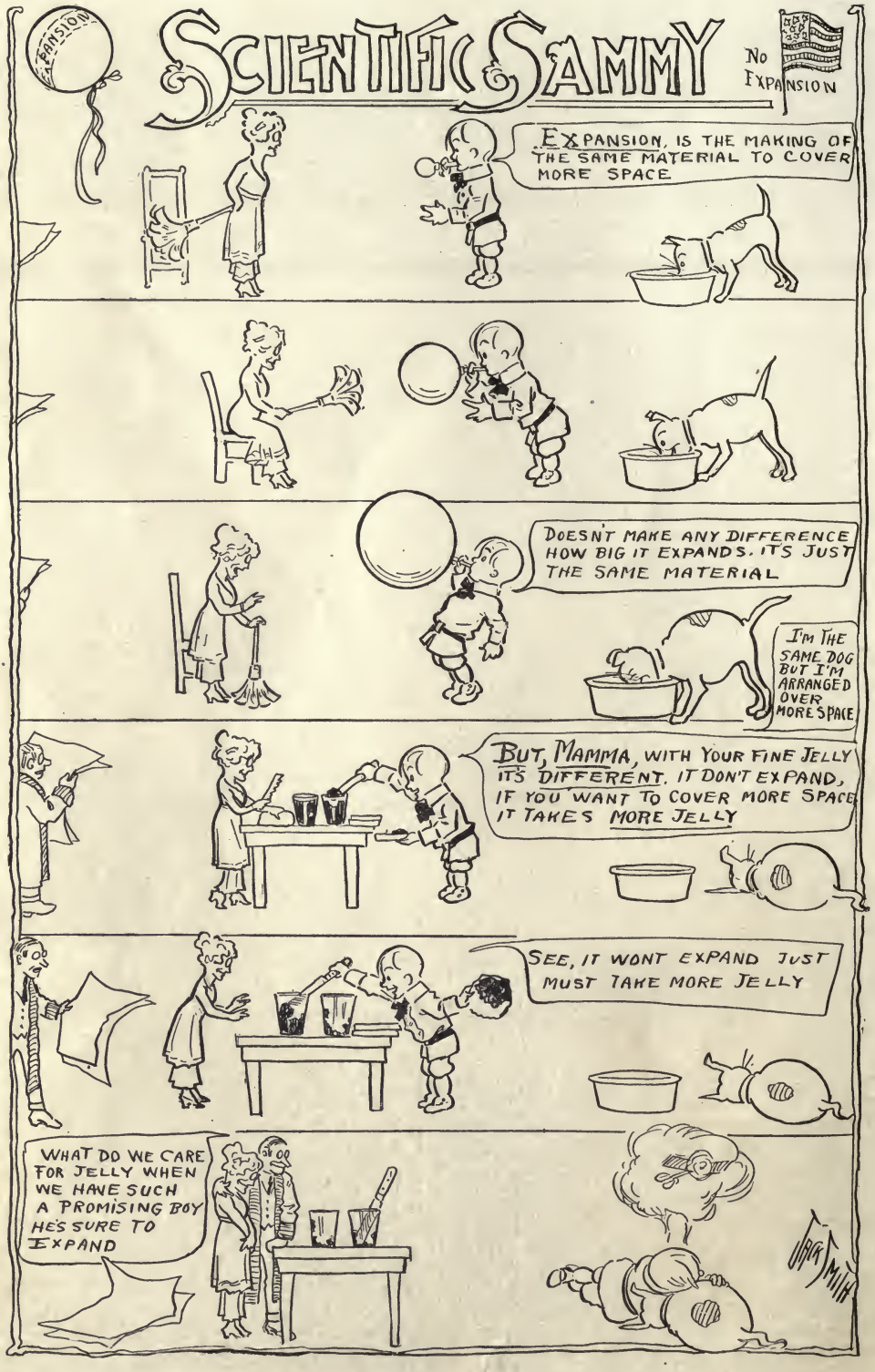
"Yes, yes, and then?"

"Her voice broke!"—*Harvard Lampoon.*

♠

Bix—You should have taken time by the forelock.

Dix—I tried to; but the other fellow got hold of it first.—*Boston Transcript.*

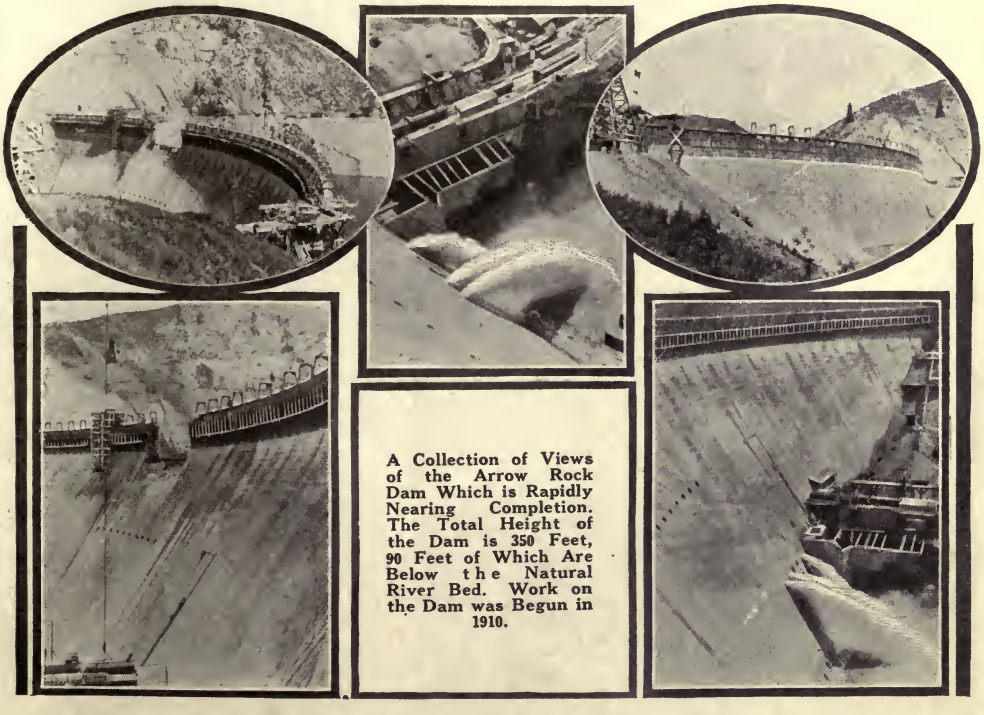

SCIENTIFIC SAMMY
EXPANSION
No EXPANSION
EXPANSION, IS THE MAKING OF THE SAME MATERIAL TO COVER MORE SPACE
DOESN'T MAKE ANY DIFFERENCE HOW BIG IT EXPANDS. ITS JUST THE SAME MATERIAL
I'M THE SAME DOG BUT I'M ARRANGED OVER MORE SPACE
BUT, MAMMA, WITH YOUR FINE JELLY ITS DIFFERENT. IT DON'T EXPAND, IF YOU WANT TO COVER MORE SPACE IT TAKES MORE JELLY
SEE, IT WONT EXPAND JUST MUST TAKE MORE JELLY
WHAT DO WE CARE FOR JELLY WHEN WE HAVE SUCH A PROMISING BOY HE'S SURE TO EXPAND
JACK SMITH

The World's Advance

Vol. 31 AUGUST, 1915 No. 2

ARROW ROCK DAM NEARING COMPLETION

ONE of the most important links in the reclamation project of the United States Government for the making fertile of 30,000,000 acres of desert land is nearing completion at Arrow Rock, Idaho. Preliminary work on the Arrow Rock Dam was done in 1910. According to the United States engineers in charge of the construction, the dam will be finished during the summer of this year—two years less than the time estimated. The construction machinery is driven by electricity generated at the Government diversion dam, twenty miles down the river, where most of the water is used for irrigation. More than half a



A Collection of Views of the Arrow Rock Dam Which is Rapidly Nearing Completion. The Total Height of the Dam is 350 Feet, 90 Feet of Which Are Below the Natural River Bed. Work on the Dam was Begun in 1910.

million cubic yards of concrete has been used in the construction of the Arrow Rock Dam.

A series of views showing the new dam and the river in its vicinity is reproduced on the foregoing page. The first view, taken from the upstream side, shows the reservoir which contained then over 125 feet of water. The two cableways were used for transporting workmen and materials. The second view was taken from a point above the south end of the structure. It will be noted that a section has been left out near the middle. The spillway will eventually be on the far side, but it is still incompleted, so that it was necessary for a portion of the dam to be left open in case of an emergency. The third view was taken directly under the downstream cableway and above the concrete mixing plant. The cableway picks up the concrete and transports it to the tower seen on top of the dam. The fourth view was taken from the spillway side looking across the downstream face. The middle tier of outlet pipes is shown discharging water. The mixing plant can be seen directly above. The fifth view was taken from the top of the dam and shows discharge openings. The high board fence was erected in front of the mixers to ward off the spray.

Thermophones were installed at different points in the concrete to indicate the temperature of the mass as the work progressed. A very interesting record has resulted which shows the high temperature of the setting concrete. This record will have future value in enabling engineers to study the expansion and contraction of concrete.

The total height of the dam is 350 feet, 90 feet of which are below the natural river bed.

THE ELECTRIQUETTE OR MOVING CHAIR

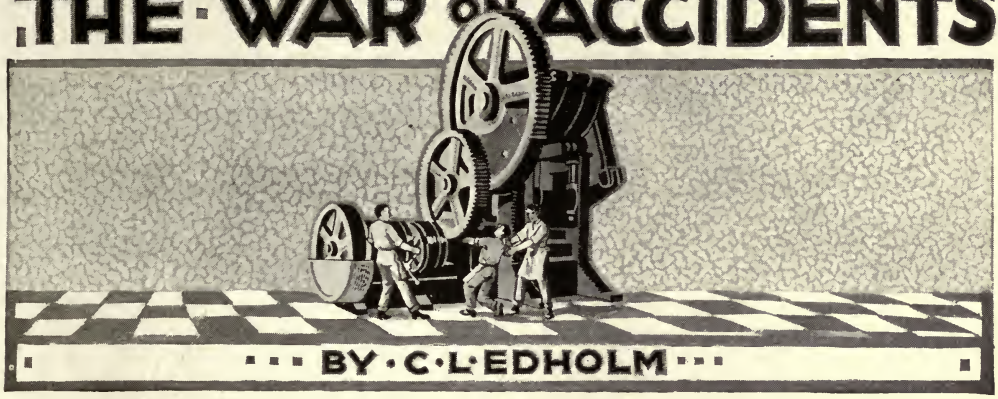
One of the interesting features of the San Diego Exposition which is now being held are the electric moving chairs or electriquettes which enable the visitors to ride around without becoming tired. In fact, these vehicles are very similar to those that may be seen at many seashore resorts, with the exception that electric current serves as the motive power.

Movable chairs were first used at the Paris Exposition in 1889 and since then they have made their appearance at most of the expositions held in different parts of the world. However, these chairs were crude affairs when compared to the electriquette which requires no "pusher." The person riding about in the electriquette can control the speed and direction in much the same way as in the ordinary electric automobile.

Vice-President Marshall Enjoying a Ride in an Electriquette.

Increasing use of the national forests by local farmers and settlers to supply their needs for timber is shown in the fact that small timber sales on the forest numbered 8,298 in 1914, against 6,182 the previous year.

THE WAR ON ACCIDENTS



BY C. L. EDHOLM

WHILE the leading powers of the world are busily engaged in a bloody struggle for supremacy, the United States is also conducting a war—a humanitarian war aiming at the reduction of the number of casualties yearly resulting in the pursuit of industrial activities. Our enemy is Carelessness, who causes as many deaths and cripples in the course of a year's work as the machine guns and shrapnel of an army in a big battle. How to reduce the danger in all lines of industry is a problem that interests the workmen and capitalists alike.

"MORE than ten thousand workers of the United States will be dead in one year from to-day, merely because they did not heed these simple suggestions." This is the sort of a prophecy based upon accident statistics that jars the most sluggish mind; and that is the intention, for it accompanies a set of instructions on how to prevent accidents among laborers—men who are so accustomed to "taking a chance" in the course of the day's work that a habit of recklessness is formed.

It was an inspiration to word the summary of accident reports in the future tense. When the average man hears that his old shop-mates, Bill and Tom and Harry, were killed as a result of somebody's carelessness, he will sigh, "tough luck," and go right on being careless in his daily work; but when it is put up to him that these good pals and ten thousand like them will be killed within a year, he is more than likely to think twice about it, and, if he is occasionally prodded, may even mend his ways.

One of the huge tire and rubber companies of the world is engaging in a systematic war on accidents, and among its principal activities is the education of the working force in habits of caution. To this all-important measure is added the inspection of the plant and the analysis of current accidents, as well as the installation of mechanical devices to guard against trouble. In the company's plant at Akron, Ohio, the idea of enlisting the employees themselves as volunteers in the "safety first" army is securing the results desired. In addition to the Central Safety Committee, which includes a number of department heads, there are nine sub-committees, each of

which consists of four workmen regularly employed in the various divisions of the great factory. They change thirteen times a year, so that in that time 468 laborers take an active interest in the prevention of accidents.

The results of this method are that the entire force is led to consider the "safety first" movement as an effort by the men for their own benefit and not as some philanthropic work done for them by their employers. That mental attitude produces the most effective results in every line of endeavor.

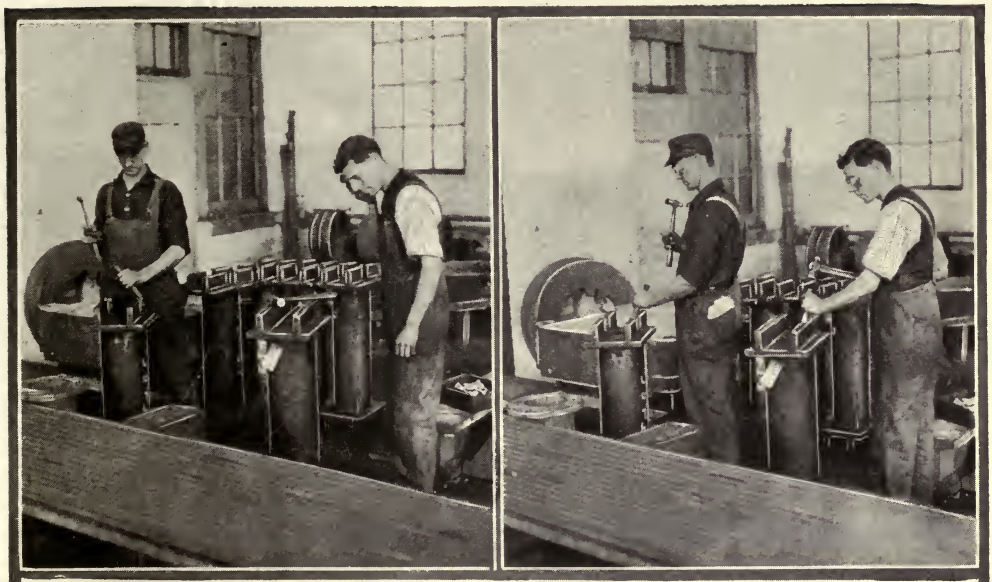
Experts direct the work, however, and the Central Safety Committee is composed of the safety engineer, fire chief, police chief, employment manager, three foremen and an experimental engineer, while a member of the Labor Department acts as secretary, and the assistant to the factory manager is the chairman. The sub-committeemen—the groups of laborers—begin their efforts with a general get-together meeting in which the general idea of the crime of carelessness is dwelt upon, and the members are impressed with their responsibility and the importance of the work they are undertaking. It is a good move to induce the men to take themselves rather seriously, and a formal visit to the factory photographer who takes official photographs of the sub-committees, is in line with that idea.

Plant inspection is the ostensible duty of these committees, for which two hours a week on the company's time is allowed. The members make their visits in pairs, alert for conditions or shop practices that may lead to accidents, and their conclusions are submitted in writing to the chairman who takes steps toward remedying genuine abuses or neglect, and returns an answer to each suggestion. In other words, no suggestion is ignored, even though it may be rejected for some valid reason which is duly explained to the committee.

While many valuable suggestions have been thus received, resulting in the elimination of dangerous conditions, the main object of the system is to educate and interest the working force of the company. Each chairman is instructed to stimulate the interest of his group by getting them together for discussion, providing them with reports on current accidents, giving them literature on the subject of "safety first" and otherwise extending the proper spirit. When the committee is through with its labors, a follow-up system is used to retain the interest of the ex-members in the movement. Every month they receive an intimate letter giving them inside information on the progress of the movement and soliciting their suggestions on new problems that may have developed. This method keeps alive their pride in safety service by appealing to their experience, while the fact that the letters are sent to ex-committeemen exclusively tends to add to their dignity.

Through these 468 men, brought in close touch with the safety movement every year, the spirit of care and thoughtfulness

Gears are Recognized as a Constant Source of Danger to the Operatives. A Simple Metal Cover Does Much to Reduce—if Not Entirely Eliminate—the Danger.



A Graphic Lesson in "Safety First" Methods: At the Left, the Old Way of Chipping Off Burrs from Castings; At the Right, the New and Safe Way.

is developed to a great extent throughout the working force.

Still other methods are used to reach all the employees directly. A weekly newspaper is published for free distribution in the factory and which carries valuable material along the line of accident prevention, although the liberal sugar coating of personal comment, chaff, cartoons and news of the force makes it far more welcome than straight "safety first" pamphlets would be. Photographs illustrating the right way and the wrong way of doing the day's work are used with telling effect, and when an accident occurs which can be described together with such photographs, the lesson is effectively driven home. In this way many careless habits that lead to mishaps are done away with.

The use of safety slogans is considered an effective method of reaching the employees. At each gate house may be found a huge sign with a brief slogan which is changed every other month. Their wording is something like this: "SAFETY FIRST. PRETTY GOOD RULE. THINK IT OVER." By putting this idea into new and crisply worded phrases, the attention of the men is caught and held, and the constant hammering away at the thought of "safety first" is bound to produce the desired results.

The Workmen are Constantly Reminded to be Careful in a Typical "Safety First" Plant.

Special attention is given to all foremen to bring them in line with the policy of accident prevention, as they have a most direct influence upon the men under them. Wherever the employment is extra hazardous, a set of rules is posted—rules, by the way, that are by no means dead letter laws. The new employees are required to memorize these regulations and strict penalties are prescribed for their violation. This system is coupled with enlightened policies regarding safety devices, guards and other accident prevention appliances that are not only provided but the use of them by the employees is enforced. The safety engineer is intrusted with this work, and he is in direct co-operation with the Central Safety Committee and also with the committees of workmen, from whose reports he frequently secures information and suggestions of value.

Such accidents as occur in spite of all these precautions are given the fullest publicity in order to impress the lesson upon the employees that "Doing things right is just as easy as doing them wrong—and a whole lot safer." The results of this effort, begun late in 1913, have shown in a year the reduction of serious injuries by one-third, and indicate that the dream of an "accident-proof factory" may be realized with persistent work on the part of the safety committee and the increasing co-operation of the men as they are educated up to the slogan at one of the gates, "IT IS YOUR FIRST DUTY TO BE CAREFUL. PREVENT INJURY. SAFETY FIRST."

CROSSING THE CONTINENT HANDCUFFED TO HIS BICYCLE.

Francis de L'Ackso, a young man from Fontainbleau, France, is crossing the continent in a most unusual manner. He is making the long trip chained to his bicycle. A chain 34 inches in length is fastened in the middle to the front vertical bar of the main frame of the bicycle, and the two ends are fastened to handcuffs or manacles which are locked on his wrists. The chain, though very short, gives him just enough slack to repair his bicycle and to guide it while riding. One of the conditions he has imposed upon himself in this queer trip across America is that he is never to be unchained from the wheel, but must eat and sleep chained and handcuffed to it.

Handcuffed to His Bicycle, This Young Man is Crossing the American Continent in a Most Novel Manner.

De L'Ackso is competing for a $1,000 prize offered by the Exposition at San Francisco for the person making the trip from New York to San Francisco in the most novel manner, not taking more than from February 26 to July 26 for the trip. The plucky young traveler has also made it one of the features of his trip to do all the repairing on his bicycle without assistance.

COAT OF CONCRETE PREVENTS RAVAGES OF SMOKE.

It is not uncommon for railroads to experience considerable trouble and expense in maintaining iron cross-over bridges; the sulphurous gases of the locomotive smoke causing the iron of these structures to deteriorate and finally become unsafe.

A Typical Iron Bridge Crossing Railroad Tracks, Which Ultimately Became Weakened by the Corrosive Effects of Locomotive Smoke.

A very novel way of solving the problem of combatting locomotive smoke ravages was recently effected by a railroad through the simple procedure of coating an iron bridge with concrete. Although the smoke darkened the white concrete walls and certainly made them unattractive in time, yet the iron was perfectly protected and the structure insured against deterioration.

RADIUM AS A FERTILIZER

Extensive tests of fertilizing fields with radium by a university in this country, although interesting from a scientific point of view, will hardly appeal to the average farmer. Experiments covering a period of two years have been made on patches of corn and soy beans with the following results:

Amounts of radium costing one dollar, ten dollars, and one hundred dollars per acre have no detectable effect on the crops. The amounts of radium emanations used by Fabre, which were unsuccessful in plots 4 inches square, would cost on a commercial scale $58,800 per acre.

If radium affects plant growth at all, the action must be that of a stimulant, it is doubtful that radium forms a source of energy, inasmuch as $1,000 worth of the element acting for three and a half months on one acre equals in total energy the sun's rays on one square foot during thirty seconds.

A French inventor has secured very promising results with an automobile driven by an aerial propeller. The propeller is shaped like a bird's wings, which is said to account for the vehicle's success.

The Same Bridge as Above After it Was Covered Over with Concrete So as to Render it Impervious to the Action of Locomotive Smoke.

True Novelty in House Numbers

NOVELTY in house numbers is one of the latest "fads" of residents in the western part of this country. This is only in keeping, however, with the unusual things these people are doing with regard to other sections of the home, such as the porch, the pillars, the driveway, the garage and the chimney. Their search for the novel and the new is resulting in that section of the country being "different," and is putting that locality in a class by itself.

Some of the novel house numbers shown on the facing page are made of wood, others are of metal, while still others are of combined materials. Some are electrically illuminated, working both night and day, while others are not. Several very new ideas are shown, such as the placing of the name of the home owner just above the number, and the forming of the numbers in cement. Some of the numbers are attached to the home itself, others are located upon the gate posts, or are situated upon the curb. The variety is so complete that a suggestion may be found to suit every requirement.

THE VIEWS APPEARING ON THE OPPOSITE PAGE ARE AS FOLLOWS:

(1) An Illuminated Number Located Between Two Homes. (2) A Combined Curb House Number and Name. (3) A Number Placed on the Edge of the Porch Roof. (4) Name Hung from Porch Beam and Number Placed on Beam Above Entrance to Home. (5) An Attractive Porch Lamp with House Number. (6) Name of the Home Painted on a Rustic Panel. (7) House Number Placed on an Entrance Pillar. (8) Another Example of a Number Placed on a Pillar. (9) Number Located on End of a Porch Beam. (10) House Number Placed on Either End of Porch Roof. (11) House Number Placed on One of the Steps Leading to It.

The style and placing of the number are things in which it is very easy to show originality. It does not take a great deal of brain effort to create something new in this line, while the pleasing result of a little work in this direction is indeed gratifying. In this work two points should be remembered. No matter what else is done, it should be made certain that the numbers are sufficiently large and so located as to be easily seen and read from the street in front of the home.

A Swedish Bicycle Intended for Chinese Postal Service.

SWEDISH BICYCLES FOR CHINESE POSTAL SERVICE.

Among other evidences of the industrial growth of Sweden and her reaching out into foreign markets, there is exhibited in the Sweden Building at the Panama-Pacific Exposition a queer-looking bicycle with a hand-brake, used in the postal service of China. This vehicle is of Swedish manufacture, and is labeled in two languages, the Chinese characters and the English words being placed one above the other on the metal panel beneath the main bar of the bicycle frame.

VIEWS SHOWING INGENIOUS DISPLAY OF HOUSE NUMBERS AND NAMES.

Electrical Voting Apparatus Being Tested Out by a Committee. The Inventor of the System Claims a Great Saving in Time and Money in Voting by This Means.

SHORTENING LEGISLATIVE SESSION BY ELECTRICAL VOTING

In order to prove to the nation that there will be a great saving in time before legislative bodies in taking roll calls by electricity, a Milwaukee inventor has offered to install at his own expense an electrical voting system for the use of any legislative body. He does not wish to be paid for the installation unless it demonstrates a saving of double its cost during a single session. The Wisconsin Legislature has taken up his offer which may mean the installation of the voting device before another legislative session. The plan is already under investigation in Congress.

Here is the manner in which he figures out the saving.

"Let us take the statement of Mr. Hambrecht, father of the bill to accept my device which was introduced at Madison, that in the 1913 legislature there were 852 roll calls. These roll calls consumed about twenty-four legislative days. Twenty-four legislative days cost the Government in the neighborhood of $24,000.

"By means of my system, 99 per cent. of the twenty-four days could be saved, and coupled with the other necessary elements in practical legislation with the efficient means which my device offers, it would shorten the session for all time to come from five to eight weeks, which would mean a saving to our State at a minimum of $35,000 per session.

"The resolution which provided for the installation of a system of electrical voting asked for an appropriation of $15,000 to install a complete system in both houses. From a business viewpoint, an investment of $15,000 would bring a return of $35,000 at a minimum every session. In other words this device would more than twice pay for itself in the first session of its installation."

The device not only records by colored lights and printed words each lawmaker's vote on a large board in full view of the assemblage, but automatically, also by electrical mechanism, keeps before the speaker of the house the totals for and against the measure voted upon.

A CLEVER DEVICE FOR TAILORS

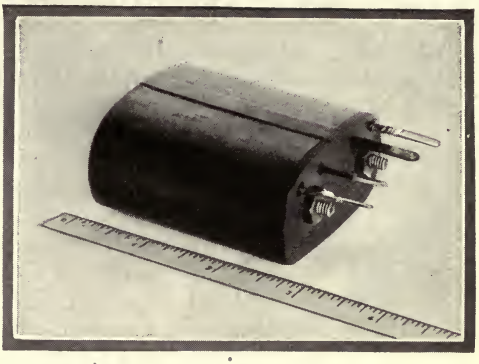
To the average man it is a difficult matter to decide on a piece of cloth for a suit and still feel confident that it will prove pleasing in the finished product. There are so many factors that enter into the making of a pleasing suit that a strip of cloth placed on a tailor's table

is almost meaningless to the majority of suit buyers.

In order to avoid disappointments to the clients as well as make the selection of different cloths a simple matter, a New Yorker has invented a simple device which he calls the "instantailor" or "garment stimulator," and on which any piece of cloth that may be selected can be placed in order to demonstrate to a client how the finished suit will be. No cutting is required to secure the effect of a finished suit.

As may be seen in the accompanying illustration, the "instantailor" is adjustable for height as well as girth. The tailor, after adjusting the form to the size of his client, has simply to pass the bolt of cloth over the device and place the framework over it. The result is a finished suit which can be carefully examined by the client in order to determine whether the color and pattern of the cloth will be pleasing.

To Secure the Effect of a Finished Suit from Any Piece of Cloth is the Purpose of a Simple Framework Known as the Instantailor.



A Clear Telephone Line from a Subscriber to the Central Office is Possible with the Use of This Automatic Locking Device Recently Invented.

DEVICE WHICH PREVENTS LISTENING ON PARTY LINES

An automatic locking device which prevents eavesdropping and interruptions on party lines will be of interest to many telephone subscribers. The lock weighs less than a pound and can be carried in the vest pocket. It may be connected to the telephone it serves or to the terminal box from which the several lines are distributed. The action is automatic, the mechanism being composed of a series of magnets and contacts which are brought into operation when a receiver any place on the party line is removed from the hook. A clear line from a subscriber to the central office is made automatically by the magnets and contacts. Telephone engineers have tested the invention and it is said to have worked properly and promptly.

BUOY LOCATES LOST SUBMARINES

One of the latest inventions to be brought out as a result of the war is a signal buoy, attached to a submarine. In case of an accident to the submarine the buoy is automatically released and floats to the surface, indicating the point where the submarine has sunk. A long reel of wire which pays out automatically anchors the buoy to the wrecked vessel. The buoy is held firmly in a steel case on the deck of the submarine by electromagnets.

A WOODEN TRAFFIC OFFICER.

Charlotte, Michigan, a town the exchequer of which will not permit salaried traffic officers, has solved the "safety first" problem at the street crossing in a most unique and effective fashion. This is accomplished through a mechanical "traffic officer" which stands at its post in all kinds of weather without salary or complaint.

A Wooden Sign Post at a Street Intersection Solves the Traffic Problems of a Small Town.

Stout cross-arms have been erected at the intersection of the principal street, properly fastened to the pavement to insure permanence. These cross-arms bear crisp, brief legends which direct the traffic. At first these devices invited some criticism because of their novelty, but practice has demonstrated their efficiency in reducing cross confusion, with the result that the idea is spreading to neighboring cities.

AUSTRIAN SUBMARINES BUILT BY AMERICANS

A recent incident demonstrates the value and efficiency of American construction and invention: The Austrian submarine known as the *U*-5 which destroyed the French cruiser *Leon Gambetta* in the Adriatic, was built by the Whitehead Company at their docks in Fiume, Austria, under license of patents belonging to the American firm known as the Electric Boat Company.

The *U*-5 was delivered to the Austrian Government as far back as 1910. According to Lawrence Y. Spear, vice-president of the Electric Boat Company, the craft was constructed under the supervision of his company, and from detailed plans supplied by them. The engines and other important machinery were constructed by the same company in this country and shipped to Austria for installation.

The vessel and her sister ship, the *U*-6, are of the same displacement, speed and radius as the five United States submarines of the *C* class which now constitute the floating defence of the Panama Canal. All the above vessels are smaller and less powerful than the more modern boats, but have nevertheless shown great utility for defensive purposes. It must be remembered that the torpedoing of the *Leon Gambetta* occurred nearly 300 miles away from the base of the submarine.

WOODEN VALVE 100 YEARS OLD FOUND IN NEW YORK.

While making excavations in one of the most congested sections of the City of New York, workmen recently came upon several relics of a day long past in the history of the water supply service of that city. The most interesting specimens of the find consisted of a number of old, wooden gate-valves, which were used in the period shortly following the war for American independence, for regulating the flow of water through the wooden pipe lines which formed the water supply system of the city at that time.

Although Buried in the Earth for Nearly 100 Years, This Wooden Valve Was Found in Excellent Condition.

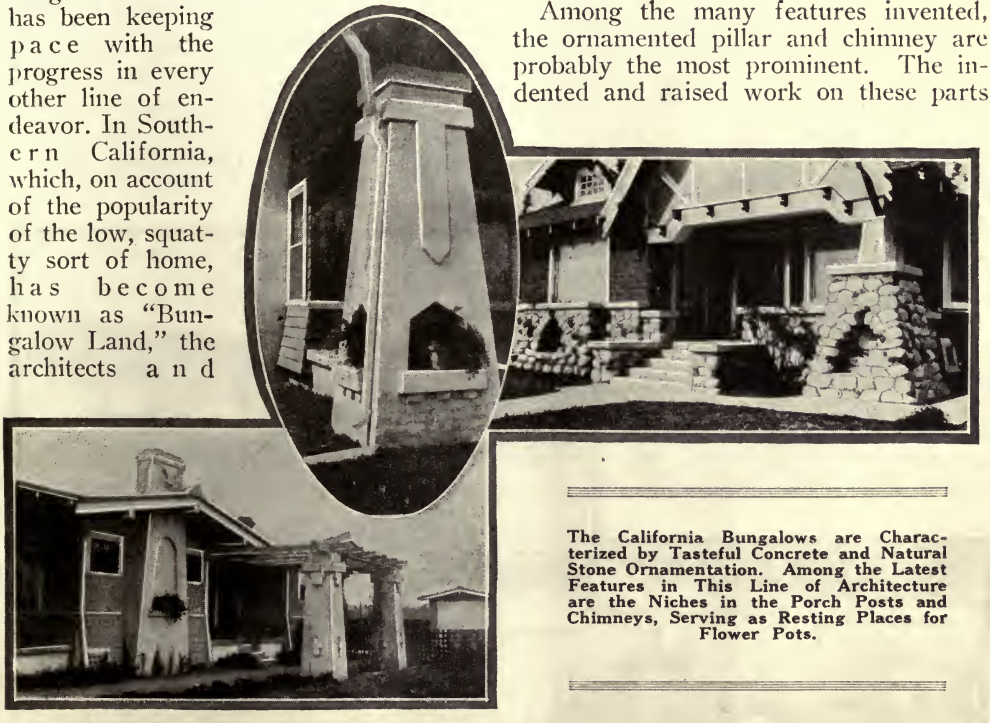
Iron was not used then for pipes, as it was considered injurious to the health to drink water which had been in con-

tact with that metal. In fact, iron pipes were not installed until about the year 1825, at which time most of the wooden pipes and valves were disconnected.

The wooden valves, one of which is shown in the accompanying illustration, were in an excellent state of preservation when found, and the iron parts in spite of their lengthy stay in the moist earth were not eaten away as much as might have been expected — certainly testifying to the excellent quality of iron manufactured in this country along in the early part of the last century.

MODERN BUNGALOW FEATURES

During the last few years the progress in the way of improvements for the bungalow home has been keeping pace with the progress in every other line of endeavor. In Southern California, which, on account of the popularity of the low, squatty sort of home, has become known as "Bungalow Land," the architects and home builders in general have been endeavoring to outdo their competitors in the line of creating something new and different for the bungalow home. To say that the work of home building in that section has been keen is putting the matter mildly.



The California Bungalows are Characterized by Tasteful Concrete and Natural Stone Ornamentation. Among the Latest Features in This Line of Architecture are the Niches in the Porch Posts and Chimneys, Serving as Resting Places for Flower Pots.

Thousands of home seekers have been flocking into that territory. They demanded homes and as a result several hundred building companies were formed, and for years the chief industry of that country has been home building. It is perfectly natural that these companies should vie with one another in the creating of new and attractive features.

Among the many features invented, the ornamented pillar and chimney are probably the most prominent. The indented and raised work on these parts of the home were the first things in the way of ornamentation to be presented. They were made in many styles and shapes and were indeed improvements. The most recent improvement, however, is the flower holder used in connection with these features. As a rule these holders consist of indentations left in the sides of the cement, brick and stone work during progress of construction. These holders are of various sizes and shapes and are employed to hold different kinds of flowers, ferns, and other plants.

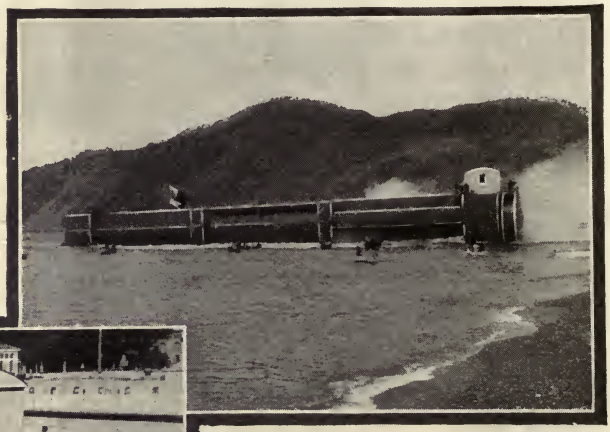
THE LAST WORD IN SALVAGE SHIPS FOR SUNKEN SUBMARINES

THE sinking of submarine *F*-4 has brought home to the people of the United States an amazing deficiency in the material of our fighting fleet. We are sadly lacking in special craft purposely equipped and intended to salve sunken submarines. In this shortcoming we lag years behind other maritime powers.

But it is not only in this direction we are wanting: we still test our under-sea boats in a crude and unsatisfactory manner in seeking to prove that they are strong enough to stand their maximum designed submergence of two hundred feet. The manner in which this trial is now made practically precludes a repetition after first acceptance from the builders, and no provision is made to detect hidden structural weakening due to service and the stress of time.

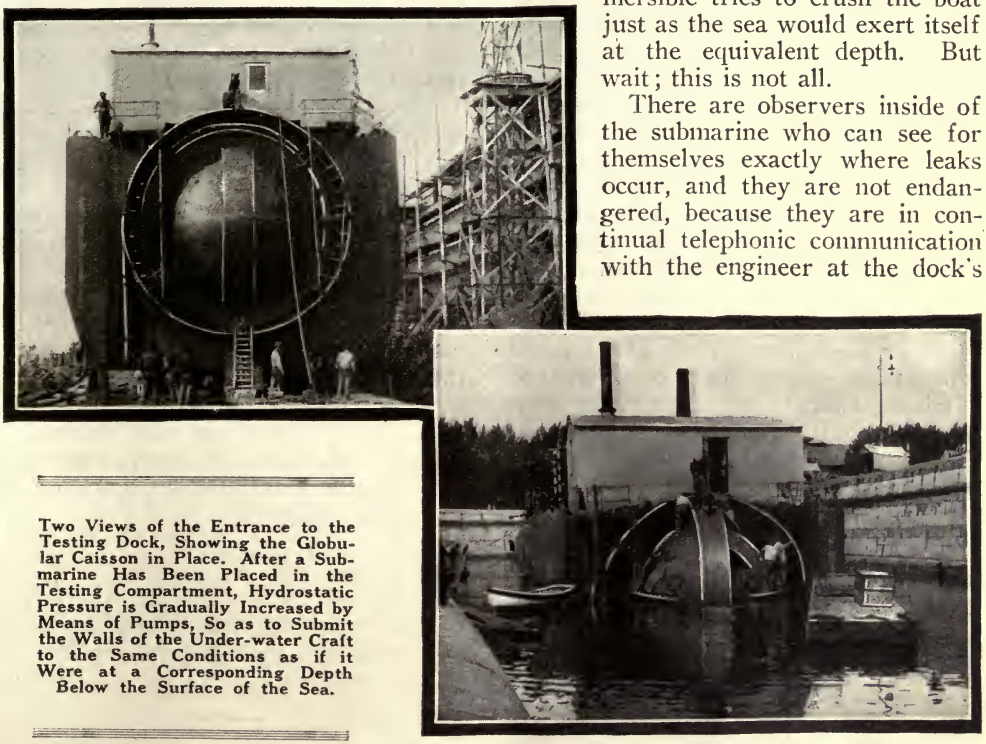
Briefly, before one of our submarines is taken over by the navy from her constructors, the boat must be taken to a reasonably sheltered spot on the coast where water at least two hundred feet deep can be found. There the craft is forcibly hauled down by a wire cable passing through a ring in a twenty-ton anchor, successively to depths of 100, 150 and 200 feet, and returned each time to the surface for examination. No one is in her during these trial dips. Structural yielding is registered at various points, if such take place, by means of instruments, and the sources of leakage are doubtless traced back by starting with tell-tale pools that may be more or less remote from the actual leak.

Trials of this sort are expensive. They take time—much of it if the weather is unfavorable, and invariably a floating machine shop has to be taken along because the building yard may be many scores of miles away. In the case of one of our submarines, the builders had to send her from Philadelphia to Castine, Maine, to find a suitably deep spot for her hull-strength submergence tests! It is largely because of these inconveniences



Above: The Launching of the Italian Testing Dock for Submarines, at the Fiat-San-Giorgio Shipyard Near Spezia. The Testing Dock Consists Essentially of a Big Tube Made of High Tensile Steel, Permanently Sealed at One End and Closed at the Other by Means of a Globular Caisson. At the Left: Entrance to the Testing Dock.

that our under-water craft never purposely go to their maximum designed depths after their one constructors' trial. This is a serious state of affairs, because the Germans have shown us how important it is for the submarines to be able to sink to the ocean bottom to give the crews a chance to rest from their nerve-racking work. Again, it is vitally necessary that the boats should be frequently examined under submerged conditions, and this can not be done in a dry-dock. What, then, is the remedy? The Italians have answered this urgent need.



Two Views of the Entrance to the Testing Dock, Showing the Globular Caisson in Place. After a Submarine Has Been Placed in the Testing Compartment, Hydrostatic Pressure is Gradually Increased by Means of Pumps, So as to Submit the Walls of the Under-water Craft to the Same Conditions as if it Were at a Corresponding Depth Below the Surface of the Sea.

The famous shipyards of the Fiat-San-Giorgio near Spezia, builders of the notable Laurenti submersibles, have evolved a special type of submarine testing dock consisting fundamentally of a big tube fashioned of high tensile steel—permanently sealed at one end and closed at the other by means of a globular caisson seated against an annular gasket of heavy rubber. Into this dock all of their boats are put; the tube filled with water and closed; and then hydrostatic pressure is applied by suitable pumps. Gradually the pressure is raised within the tube, and the water enveloping the submersible tries to crush the boat just as the sea would exert itself at the equivalent depth. But wait; this is not all.

There are observers inside of the submarine who can see for themselves exactly where leaks occur, and they are not endangered, because they are in continual telephonic communication with the engineer at the dock's pressure pump. Instantly the pressure of the enveloping water can be released. Thus, right at the building yard, a submersible can be tested under physical conditions that actually reproduce those of a deep submergence, and it is not necessary to wait for the weather or to go hunting for some out-of-the-way hole along the coast. More than this, boats can be frequently tested in this way—should be, in fact—and all of their emergency apparatus, such as automatic blow-outs for the quick expulsion of water-ballast and pumps designed to work against great heads of water, can be put through their paces to see that they are fit and capable. To-day our sailors and officers have to take a good deal of this readiness for granted!

Some years ago a French boat was lost because a pebble was jammed in one of

the sea-valves, and that little stone was forced in when the submarine grounded on a sandbank about a week before she foundered. One of our own submarines narrowly escaped loss because an engine exhaust-valve became fouled and would not seat properly. Again, another underwater craft had some of her tanks flooded with an excess of ballast because of a chip of wood that had clogged a valve. We must remember that the sea is more of an enemy toward the submarine than toward a surface vessel, for the reason that when the submersible is in battle trim she is completely surrounded by water seeking an entrance with increasing force as the boat settles deeper beneath the waves.

Since the Laurenti dock first made its appearance about four years ago the Fiat-San-Giorgio has developed a novel advance in the shape of a mother-ship having within her a tubular testing dock long enough to receive submarines up to 190 feet in length. This special craft has a normal seagoing displacement of 3000 tons and can make 14 knots an hour at full speed. She is driven by two heavy oil Diesel engines operating twin screws, and at a 10-knot cruising speed has sufficient fuel to take her 4000 miles. The mother-ship uses the same fuel as the submarines, for which she constitutes a mobile supply base.

The Italian government has just added to its fleet a special vessel of this sort. She is at once a mother-ship, a supply ship, a repair vessel, a testing dock—the tube can also be used as a dry-dock, and a salvage craft capable of raising a sunken submarine. The mother-ship is supplied with numerous compressors and dynamos so that she can charge the air-flasks of a flotilla and also charge the storage batteries—thus saving the machinery of the submarines. In order that she can hold her own against an enemy's destroyers, the mother-ship carries a battery of rapid-fire guns of the necessary calibre.

DIMINUTIVE RAILROAD FOR FREIGHT YARD SERVICE

A portable track and car of small size is in use in a Brooklyn freight yard for transporting heavy objects. Where space is limited a portable railroad of this sort is useful. The track is made in sections of six feet, which may be readily bolted. A turntable is used when there are corners to run.

A Portable Railway and Hand Truck Greatly Facilitate the Handling of Merchandise.

"MOVIES" ON A SKY-SCRAPER

An innovation is planned by the architects at work on the sky-scraper to be erected by the Consolidated Gas, Electric Light & Power Company in the heart of the Baltimore shopping district. On the roof of the twenty-two story structure a moving picture parlor will be installed.

This enterprise will be started in an auditorium which will have a seating capacity of between 600 and 800 people. It will not be confined to the use of the occupants of the building, it is understood, and artistic announcements of the various pictures to be shown will be displayed in the foyer or lobby of the theatre.

A PIONEER AMERICAN LOCOMOTIVE

"GOVERNOR STANFORD," the first engine over the Central Pacific Railroad, is a typical old-timer, with its diamond-shaped smoke-stack, huge headlight and pilot. The Central Pacific was the last link in the first transcontinental railroad and was completed in 1869.

IN THE REAR OF THE TEUTONIC BATTLE LINES

Russian prisoners in Germany put to work building a stockade in which they are to be confined. There are a large number of Russian prisoners in both Germany and Austria, especially since the terrific Austro-German drive in Galicia, which has resulted in the retaking of much Austrian territory, including the fortress of Przemysl.

One of the famous Austro-Hungarian motor guns in a wood in Russian Poland. This gun is interesting not only because of the remarkable way in which it is loaded—the view shows a projectile sliding on rails into the breech—but also because it can be taken apart, placed on heavy motor trucks and transported from place to place.

A heavy tractor used in hauling the big German guns.

German infantry using scaling ladders in order to leave their intrenched position and attack the enemy. Ladders are used by both German and Allied troops to facilitate leaving deep trenches.

Photos. Robert H. Moulton.

WITH THE GERMANS IN THE EAST AND WEST

German troops defending the ruins of a house against the attacks of the enemy. Practically every building of substantial construction in the war zone is converted into a veritable fort, not only manned by infantry but also equipped with machine guns and even field pieces.

The Kaiser and his brother, Prince Henry of Prussia, leaving the Kaiser's headquarters for a walk. Prince Henry, who is well known to Americans because of his visits to this country in the past, is identified with the naval forces of Germany in the present war.

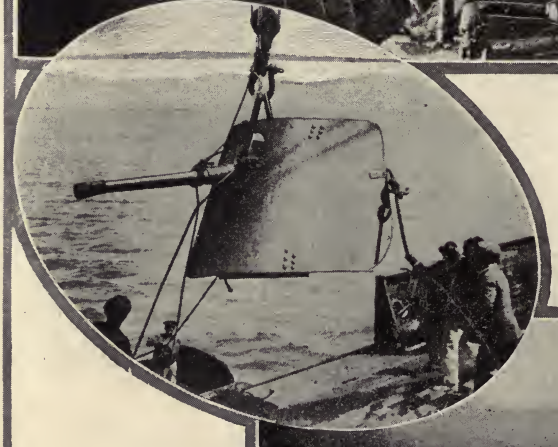
Below: An observation post for German batteries in Poland.

Above: From one end of the German east front to the other long trenches have been dug and protected by abatis of barbed wire. In this view the soldiers are seen at work making the abatis for protecting the trenches against the charges of the enemy.

Photos. Robert H. Moulton.

ARTILLERY—THE GREAT ARM OF THE FIGHTERS

German machine gun squad shooting at an enemy aeroplane. Her preponderance in machine guns has done much to enable Germany to hold most of the territory acquired by her since the war, even in the face of attacks by the numerically superior forces of the Allies on the western front.



Above: Placing in position a heavy Austrian gun in the Carpathian mountains. At the Left: A British twelve-pound gun for use on an armored train, being taken ashore for the warfare in German Southwest Africa.

Four hundred French and English field pieces which have been captured by the German armies.

Photos. Copyrighted International News Service.

THE WAR AS VIEWED BY THE FRENCH SOLDIERS

A traction engine employed by the French troops in connection with a harrow or similar implement for the purpose of leveling fields that have been broken up by shell fire. With this tractor a plow or harrow may be drawn by means of a cable winding on a drum.

A scene at St. Eloi, France, where some of the fiercest fighting has taken place. The holes in the wall serve as passageways from house to house.

French soldiers examining the base of a German shell which exploded and caused the big hole in the ground. More ammunition has been used in the present war to date than that consumed in all the wars prior to August 1, 1914.

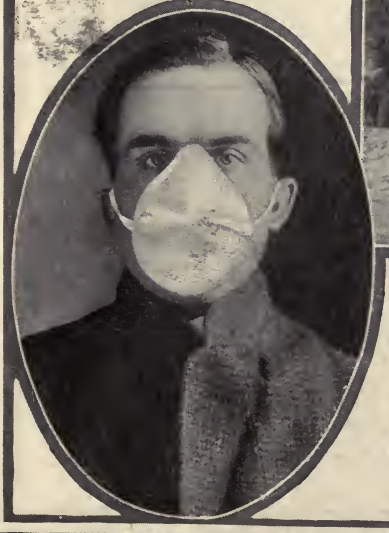
Photos. Copyrighted International News Service.

WARFARE WITH GAS CLOUDS AND BOMBS

A German trench mortar used especially for the hurling of gas bombs, captured by the French. The asphyxiating gas employed by the Germans is either released into the air and blown over the enemy's lines by the wind, or is placed in bombs and shot from special mortars.

French infantrymen who have been victims of a German gas attack.

A company of British infantry wearing special respirators for protection against German gas attacks.



Type of respirator worn by the French soldiers and which forms an effective protection against the asphyxiating gas clouds employed by the Germans. The respirators are very simple in design, yet their use enables the British and French infantrymen to hold their trenches in the face of a gas cloud and repel the German infantry attacks that generally follow.

Photos. Copyrighted International News Service.

VEGETABLE FIBRE OF GREAT BUOYANCY

Playing a game of cards in the water, using a floating table consisting of carded Kapok — a vegetable fibre which is impervious to atmospheric conditions and water, and is unsinkable. The players are dressed in suits containing Kapok.

Different styles of sunts that have been filled with Kapok. At the Left: An aviator's costume. In the Center: Life-saving vest for women and children. At the Right: An admiralty service jacket. Kapok is a British discovery which is now receiving extensive tests.

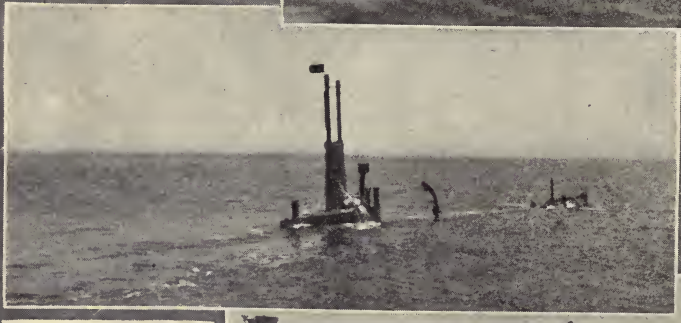
Two men floating in the water, due to the buoyancy of Kapok. One of them is resting on a blanket of carded Kapok measuring five feet by two feet six inches and which will keep any person afloat for an indefinite length of time. The other man is wearing a Kapok padded suit.

Photos. Copyrighted International News Service.

AMERICAN SUBMARINE AT BATTLE PRACTICE

The United States submarine "H-2" firing a torpedo during target practice at San Pedro, California.

A spent torpedo fired during maneuvers The trail of the torpedo through the water can be easily followed by the foaming wake left by the missile.



The American submarine "H-2" coming up to the surface after a submerged run, during the maneuvers at San Pedro.

The crew of the "H-2" hoisting a spent practice torpedo on board. The torpedoes are fitted with dummy heads for target practice and are picked up by the crew, recharged with compressed air and used over again.

Photos. Copyrighted International News Service.

AN ACTIVE AMERICAN VOLCANO

One of the results of the eruption of Mount Lassen in California: Big trees that have been uprooted by the flood of mud and water strewn in piles on the sides of the mountain.

General view of the wreckage in Loss Creek. This locality was once fine ranch land, but it has been transformed by the volcanic eruption into a chaotic mass of mud and lava.

North side of Mount Lassen, showing the crater of the mountain. Much of the landscape that appears in this view was damaged by the eruption.

A view of Mount Lassen as seen from the south side of the mountain. This is one of the Californian volcanoes that have long been considered extinct.

Photos. Copyrighted International News Service.

RELIEF EXPEDITION SAILS FOR THE NORTH

The auxiliary schooner "George B. Cluett" starting out from New York on the first leg of her long journey to North Greenland.

Captain H. C. Pickles, Commander of the MacMillan Relief Expedition, which started off on the auxiliary schooner "George B. Cluett" on June 9, bound for Etah, with the object of finding Donald B. MacMillan and his party. MacMillan set out in 1913 under the auspices of the American Museum of Natural History.

Members of the crew of the auxiliary schooner "George B. Cluett" and their mascot, photographed just before they sailed from New York under the command of Captain H. C. Pickles and Dr. Hovey of the American Museum of Natural History. They are supplied with two years' provisions and fuel. The expedition will endeavor to locate Donald B. MacMillan and his party, who set out two years ago for the purpose of finding Crocker Land, first reported by Admiral Peary.

Photos. Copyrighted International News Service

THE BRITISH TROOP TRAIN CATASTROPHE

At the Right: The burning debris of three coaches in the troop train disaster at Gretna, England.

Above: A burning coach.

Two telescoped coaches which escaped the conflagration following the train wreck. The Gretna catastrophe resulted in a death toll of over 200, 194 of the victims being soldiers.

Two of the wrecked engines in the Gretna wreck. A wreckage crane may be seen in the background at work clearing the tracks of the debris.

A near view of a coach that has been partially consumed by fire, leaving just the framework. The Gretna catastrophe is one of England's greatest train wrecks and would have been a world-wide topic had it not been for the all-important events of the European war which overshadow all other happenings of today.

Photos. Copyrighted International News Service.

CAPE COD CANAL AND CALIFORNIA WASHOUTS

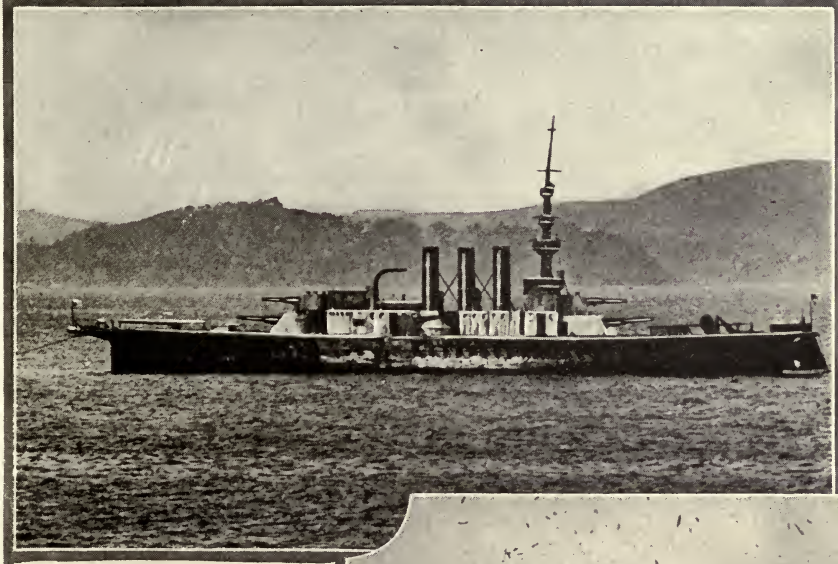
The "James S. Whitney," the first ocean liner to pass through the Cape Cod Canal on May 21, 1915, the opening day of the recently completed waterway for ocean steamers. The Canal saves seventy miles' travel in the journey from Boston to New York. The "James S. Whitney" went through the Canal in one hour, the distance from one end to the other being eight miles.

A near view of a washout in northern California and its effect on a railroad track. The rails and wooden ties have been left hanging in the air after the earth beneath them was washed away by a torrent of water.

A general view of the same washout which was caused by heavy rains. One hundred and fifty feet of railroad track was left suspended in the air when the embankment was swept away. A telegraph pole may be seen suspended in the air, hanging from the telegraph wires.

Photos. Copyrighted International News Service.

PROVING THE EFFICACY OF MILITARY MINES



One of the most spectacular entertainments of the Panama-Pacific Exposition was the recent blowing up of a "battleship" built of papier mache and canvas. In order to demonstrate the effectiveness of mines in defensive naval operations, mines were planted in the waters adjoining the Exposition Grounds, under the supervision of Colonel S. M. Foote, Commander of the United States Pacific Coast Defense, and Major H. H. Whitney. The battleship "Zone" was constructed of papier mache and canvas on the hulk of the old Southern Pacific ferry boat "Amador." The ferry boat was launched in 1869 and kept in service until 1914, when it was condemned. One of the views shows the "battleship" before it was blown up, while the other was photographed at the moment it struck a mine.

Photos. Copyrighted International News Service.

VARIED MOMENTS WITH EUROPEAN FIGHTERS

Above: An Austrian army resting during a march through the Carpathians. At the Left: French soldiers wearing steel skull caps. These head pieces are usually the gifts of relatives and friends, being sold in Paris and other French cities at practically cost price. They have proven invaluable protection against enemy bullets and shell splinters. Below: A remarkable photograph taken in an Austrian trench in Russian Poland. This view, showing the defenders actually repulsing a vigorous Russian attack, was taken by the photographer at a considerable risk.

Photos. Copyrighted International News Service.

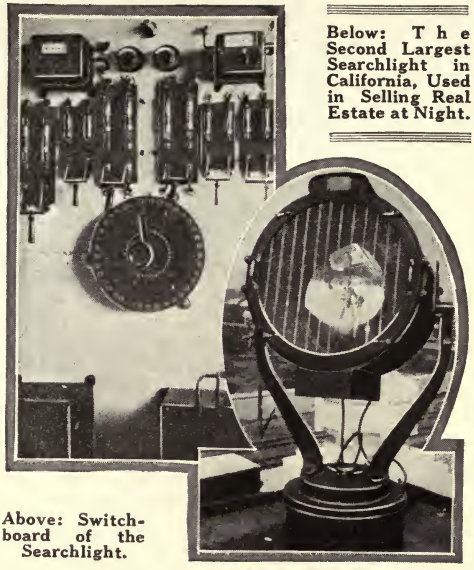
NEW USE OF GRAPHITE SAVES INNER TUBES OF TIRES

Coated with graphite instead of soapstone, which was formerly used, the inner tubes of automobile tires have been discovered to last twice as long as under the old process. This new process of coating is being used by a western tire concern in the manufacture of their tires. Graphite prevents blooming, deterioration, and absolutely eliminates friction between the inner tube and casing. It is impossible to destroy graphite, wear it out or make it change its form, the latter being the main drawback in the use of soapstone.

MOTOR CANOE OF NOVEL DESIGN

A Japanese photographer of Battle Creek, Michigan, has built a most unusual water craft in the form of a motor canoe. He took an ordinary canoe and placed in the bow a detachable motor boat arrangement, which pulls the canoe forward when the motor is operated reversely. At the stern of the canoe he rigged up an aeroplane propeller, which is driven by a separate engine. In order to insure safety, pontoons were fastened on either side of the craft, and the steering gear of both motors was placed within easy reach near the center of the canoe. The motor-canoe is said to be much safer than the average canoe, and considerable speed can be developed by this strange harnessing of power.

Propelled by Both a Marine and Aerial Propeller, This Canoe is Claimed to be Safer Than the Ordinary Craft of That Class—and Far Speedier.



Below: The Second Largest Searchlight in California, Used in Selling Real Estate at Night.

Above: Switchboard of the Searchlight.

"SELLING THE EARTH" AT NIGHT

For years the brains of all the real estate men of Southern California have been busy in devising new ways and means of "selling the earth." Every method that has come up to improve the appearance of a new tract and that would tend to quicker selling has been eagerly grasped and worked, and, it might be said, "worked to a standstill." But after everything is said it remained for the Harry H. Culver Company, of Los Angeles, to introduce the most novel method yet employed. By this company's method a large searchlight is introduced into the real estate business. It has a two-fold purpose and effect. First, it attracts attention to the city, for its rays may be seen for miles around; second, it permits the sale of real estate by night, this probably being its strongest feature. There are hundreds of people who are unable to visit Culver City during the day and these people are shown the land during the dark hours. The light is located upon the top of a three-story building, and from this point it is a simple matter to turn its strong ray of light upon any lot or section of lots in the entire

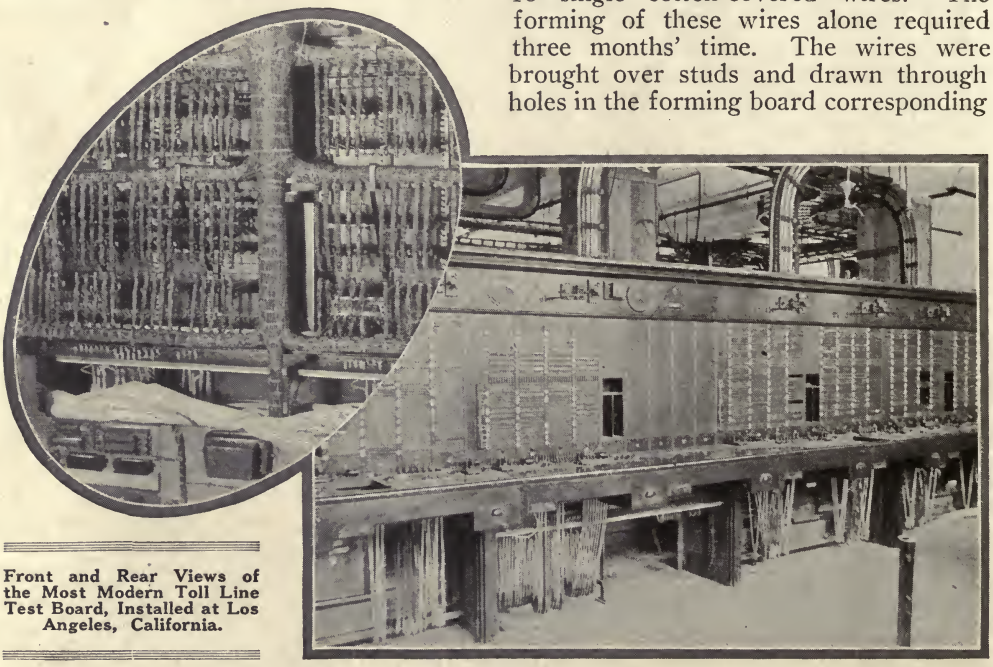
city. The point upon which its rays are turned is made as light as noonday, and selections in real estate may easily and safely be made.

The searchlight is a very powerful one, being second in Southern California only to the celebrated Mt. Lowe searchlight. It has a rating of 8,500,000 candle-power and throws a brilliant stream of light a distance of thirty-two miles. The lamp itself is thirty inches deep and thirty inches in diameter. The light and the stand upon which it rests have a combined height of five and a half feet.

The switch room for this light is located on the floor below it. In this room are switches, meters, starting boxes and other controlling devices, as well as a 60-cycle, 15 horsepower electric motor and a 56-ampere continuous current generator.

NEWEST LONG DISTANCE TELEPHONE TEST BOARD

The most up-to-date toll-line test board in the world comprises part of the recently completed new long-distance exchange at Los Angeles, Cal. Any line, inside or outside of the exchange, may be plugged into the board for any kind of test imaginable. Breaks or crosses on long lines are measured to a fraction of a mile with a Wheatstone bridge and galvanometer. A line inside the exchange causing trouble is cut off from its corresponding line outside and another line temporarily "patched in" through plugs in the board.



Front and Rear Views of the Most Modern Toll Line Test Board, Installed at Los Angeles, California.

Each form in the rear of the board supplies two of the eight sections. Leading in at the top are 1,800 pairs of No. 16 single cotton-covered wires. The forming of these wires alone required three months' time. The wires were brought over studs and drawn through holes in the forming board corresponding to the jacks to which they lead. The form was then sewed with No. 12 thread lock-stitches and the board removed. It was then given a coat of shellac, followed by the most tedious job of all, the connecting and soldering. The final dressing-up and shellacing alone took one man two weeks' time.

Motion Picture Exhibit of School Activities

By Thomas J. Davis

DURING the past few years motion pictures have been used in various departments of school work and have proved of great value as a supplement to textbook and oral instruction. Not only have they been the means of imparting to pupils in an interesting way a vast fund of information concerning a variety of subjects and of enabling pupils to obtain a clear conception of many of the principles of science, art, and other subjects, but also, by portraying actual working conditions in industrial and business enterprises, they have given school children a more definite understanding of how things are done in the real workshops of life than the scholars could possibly acquire through any amount of theoretical instruction.

Since motion pictures have thus been used to show teachers and pupils what is going on outside the school walls, it is but fitting that they should be used to demonstrate to the rest of the world what the schools are doing. There is no exaggeration in saying that the average adult is as ignorant of modern school activities as the average school child is ignorant of the industrial, commercial and social activities of modern life. This is especially true in large cosmopolitan cities which maintain, in addition to the regular academic schools, polytechnic high schools, schools of manual arts, trade, neighborhood, continuation and other schools of the very existence of which many of the people of any city are entirely unaware.

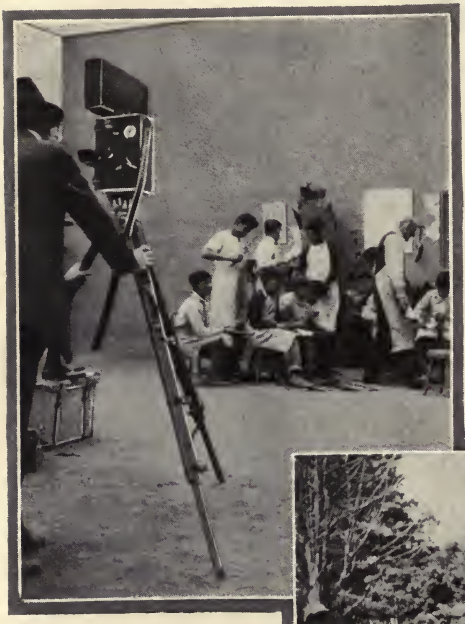
It has always been difficult, indeed impossible, to get any large number of men and women to visit the public schools, and schoolmen everywhere have longed for some means of showing their patrons the essential facts concerning the equipment, accomplishments and needs of the schools under their direction. Motion pictures are the fulfilment of that wish.

Among the very first cities to employ this means of publicity is Los Angeles, Cal., where there has just been completed a remarkable record, six thousand feet in length, of the activities of the public schools. This six reel film was made primarily for the educational exhibit at the Panama-Pacific International Exposition, but later it will be shown throughout California and in all the large cities of the country.

These pictures cover the work of all grades from the nursery to the junior college. There are exterior and interior views of some of the more modern buildings and many views of equipment. Regular academic classes are shown where it is possible to illustrate an unique method of instruction or to present a typical grouping of nationalities. Many pictures of school shops, kitchens, sewing

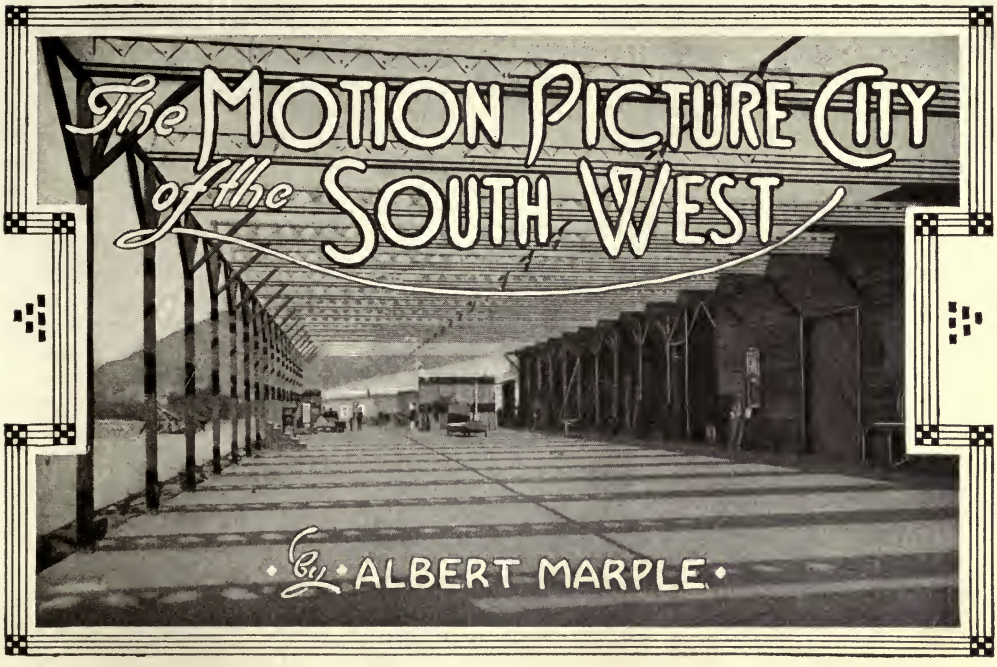
rooms and gardens testify to an earnest endeavor to approximate, in methods and equipment, actual working conditions. Outdoor school life is represented by many views not only of physical culture drills and regular athletic sports, but also of outdoor classes, nursery games, kindergarten plays, folk dances, trips to the beaches and the mountains, camp life, and many other school exercises that in most parts of the country must be conducted indoors. The pictures of neighborhood and continuation schools show how these may be made to serve the communities in which they are located in all their diversified affairs, domestic, industrial and economic, which in any way contribute to the welfare of their children. The views of the intermediate school activities will be of especial interest to educators, for they demonstrate the excellent results that have been attained in these special schools which have been organized out of what was formerly the seventh and eighth and ninth grades, and the work of which has been planned to bridge the chasm that has always existed between the grammar and the high school. Not the least interesting of the pictures are those which show how the home economics department seeks to train all school girls to become true home makers and how the manual training department is striving to develop some degree of manual dexterity in all school boys and at the same time familiarize them with some of the constructive processes by which "society keeps itself going." The high school pictures show the culmination of the many lines of work which the pupils have pursued from grade to grade and those special activities by which they are prepared for the duties and responsibilities of life.

All in all, these reels constitute one of the most important educational films ever shown. They tell a story of vital interest to the people not only of Los Angeles, but of the rest of the country as well.



Taking Motion Pictures of the Activities of One of the Los Angeles Schools. Many of These Pictures are Taken Outdoors in Order to Secure Better Photography.

Fifteen expert cameramen are engaged in the "taking" of the scenes for "The Diamond from the Sky," the great Flying "A" serial photoplay.



TWO years ago one of the leading motion picture producers conceived the idea of a community that would be exclusively devoted to the making of photoplays. Today the idea is realized in the vast ranch and municipality known as Universal City, located in the beautiful San Fernando Valley of California. Although this community has already been described in a past issue under the caption "Chameleon City," its recent completion permits of a more detailed account of the many wonders of the world's only motion picture city.

ANY ONE who is familiar with the producing of motion pictures is aware that slowly but surely the film companies are taking up their residence in southern California. At the present moment it is estimated that three-fourths of the films manufactured, or rather motion pictures produced, come from that favored section. The annual payroll of employees of the motion picture companies in southern California is at this moment about $7,000,000. It is claimed that the property and equipment of these companies is worth more than $3,000,000, and that this sum will ultimately be increased to $6,000,000 when the many improvements planned and now under way are consummated. The actors and actresses alone number over 10,000.

But the object of this story is not to tell how many companies are located in

California, for these facts are merely mentioned in order to convey to the reader's mind a fair conception of the magnitude of the motion picture industry in that sunny locality. The story is rather to literally convey the reader through one of the largest—if not the largest—producing plants in the United States.

The Universal Film Manufacturing Company has the unique distinction of being the first motion picture producing firm to own an entire city for the carrying on of the work. While other companies are spending vast sums of money in acquiring land and erecting huge studios and laboratories, it is probable that no other company is doing this work on such a stupendous scale as the Universal.

Prior to about two years ago the main plant of the Universal was situated in Hollywood, Cal. At that time the officials of the company realized the growing necessity of spreading out, and, fitting the action to the decision, the company purchased a large piece of land — something like 500 acres—in the beautiful San Fernando Valley. Improvements were started at that time which will eventually total up more than $2,000,000.

Above: Wooden Drums on Which Films Are Dried. In the Oval: A Cutting Room Where Films Are Assembled.

Universal City, as the entire community and plant are named, includes practically everything that is necessary for the staging and manufacturing of motion pictures. It is very seldom indeed that the directors are compelled to leave the grounds for any setting. The property includes hilly land both with and without dense growth of trees, valley property, wash property in which desert scenes are staged, and an abundance of land especially suited for street scenes and city atmosphere. The Los Angeles River runs directly through the center of the property, so that water scenes of all kinds are possible, while the convertible bridge crossing the river is so designed that it may be changed in a few minutes' time from one type of structure to another for use in different pictures.

Everything that could be desired by a motion picture director is available in Universal City. Mr. H. L. Caulfield, general manager of the Pacific Coast studios of the company, has proved himself a wizard in the selection of a site as well as in the planning and construction of the community.

The various brands of the Universal company which are known to many "movie fans" employ regularly about 2,000 actors and actresses, or a payroll of more than $26,000 weekly.

There are two distinctive sections to Universal City — the ranch section, which was completed more than a year ago, and the new section which has just been completed. For the most part the ranch is used in making pictures of western life, Indian subjects and other photoplays that necessitate rugged backgrounds. On the other hand, the new section is employed in producing pictures requiring special and elaborate settings; the permanent buildings in this section being constructed of reinforced concrete. In the construc- of these buildings 150 carloads of rock has been employed, as well as twenty-five carloads of cement.

The main feature of the new section of Universal City, and, in fact, of the entire property, is the enormous outdoor stage which is built entirely of reinforced concrete and steel framework. It covers a ground space of 156 by 320 feet.

The concrete of the floor is six inches in thickness, as are likewise the walls of the buildings adjoining it. At the rear of the stage are the dressing rooms, directors' offices, toilets and shower baths. Hot and cold water, electricity and all other modern conveniences are features of the stage. In the "acting" space there are three pits, twelve feet deep, which are intended for water and basement pictures. These pits are 10 by 20 feet in size and are lined with concrete floors and walls ten inches in thickness. The stage has two scene docks 50 by 120 feet, the roofs of which are used to house the light diffusers. The acting space measures 65 by 320 feet and is covered over with span steel trusses upon which the diffuser tracks are run.

Various Scenes of Universal City: In the Uppermost View, a Scene in the Hospital of the City. In the Oval: Isidor Bernstein, the Man Who Did Much to Make Universal City What It is Today. Above: The Mammoth Outdoor Stage Where Many "Interior" Scenes Are Photographed. At the Right: A Desert Picture Staged at Universal City.

Universal City is a modern motion picture community in every sense of the word. It has its own sewerage, water supply and electric lighting systems, telephones and telegraph service. Miss Laura Oakley, a prominent actress, is chief of police of the entire city, and residents claim that the community is the most law abiding in the United States. The city has been incorporated as a city of the sixth class. It has a United States post office and money orders can be sent and received there.

The principal building in the new sec-

tion of the city is the administration building. This contains the manager's office, directors' office, reception hall, bank, business office, telephone and telegraph booths and literary rooms, while above the center of the main floor is the observation tower from which the manager may see all sections of the ranch.

Directly to the left of the administration building is the carpenter shop, where all of the accessories needed by the moving picture city will be manufactured. In this building is also located the plumbing shop, electricians' headquarters, and the drafting rooms, as well as the dark rooms and camera rooms. The restaurant and confectionery stand for this section are located at the right of the administration building. There is both an open air and a closed café.

The hospital, which has a trained nurse and a physician always in attendance, is being erected on the hillside. It will have two wards, one for the men and the other for the women, each having two beds.

THE VIEWS OF UNIVERSAL CITY APPEARING ON THE OPPOSITE PAGE ARE:

(1) The Front of the Administration Building. (2) The Restaurant Building. (3) One of the Bunkhouses Built Especially for the Cowboys. (4) A Bird's-eye View of the New Part of the City. (5) General View of the Ranch Part of the City. (6) One of the Several Sewerage Pipes That Form the Sanitary System of the City. (7) A Few of the Animal Cages at the Zoo. (8) Entrance to the City as Seen from the Boulevard.

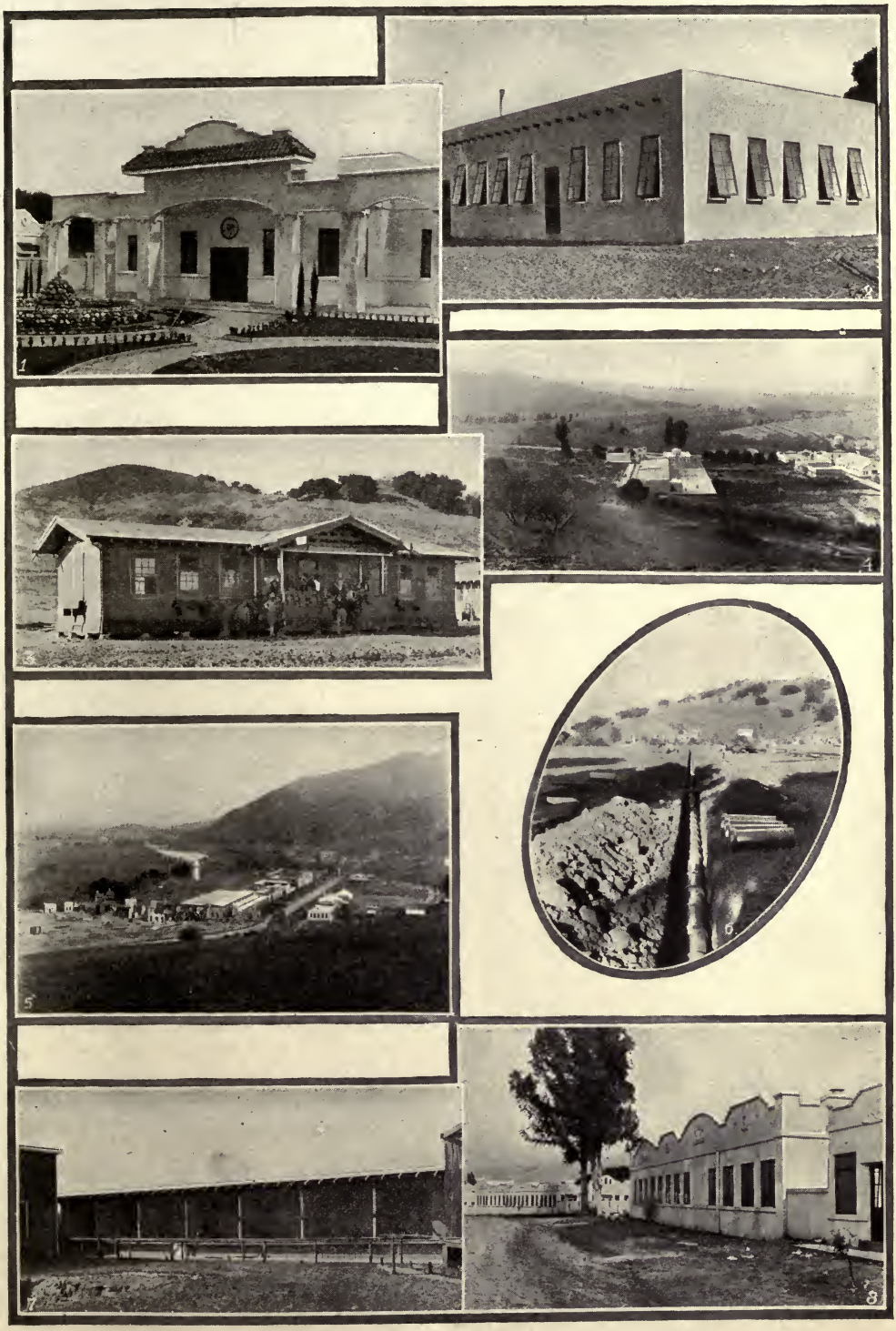
In one of the canyons close by there is a Roman theatre and a stadium, having a seating capacity of about 1,400 people. The grounds before and behind the buildings are laid out in lawns, there being a Roman bath with pool and fountain. There is also a building, 50 by 200 feet, known as the electric studio, where pictures may be made during rainy weather and at night.

The ranch or western section of the city is just as interesting, if not a little more so, than the new portion. This is truly an "out west" locality, with real cowboys and genuine Indians. In this section is also a large stage behind which are dozens of dressing rooms and property rooms. Farther on is a fully equipped carpenter shop and scenery department. A prominent feature of this section is a large zoo, containing twenty camels, two elephants, several lions, seals, tigers, leopards, snakes, bears, wolves, dogs and monkeys; among the latter being Joe, the chimpanzee who sleeps in a real brass bed, picks his teeth after meals, and has several other habits of the human race.

Still further on are harness and blacksmith shops, which are built to resemble buildings characteristic of old England. Directly in the center of the zoo enclosure is an immense arena where the Roman thrillers are staged. This arena is equipped with a maze of tiny cages where, in times of danger, the camera men and actors may seek safety. The arsenal is near the blacksmith shop and contains a wide variety of firearms of all kinds, which are found indispensable in producing many of the photoplays. There is also a large corral which contains upward of one hundred and fifty horses, situated directly behind the arena.

The water supply of the city is secured from six wells which have been dug on the ranch. Two reservoirs have been constructed upon the hillside, one of which contains 150,000 gallons for domestic purposes, while the other holds 500,000 gallons, this being for fire purposes only and supplying fire hydrants located in various parts of the ranch through six-inch mains. The sewerage system consists of a modern septic tank and several miles of eight-inch pipe. From one end of the city to the other and connecting the ranch with the new section is a macadam boulevard, twenty feet wide with five-foot shoulders. The roadway has an eight-inch rock base and cost $12,000 to build.

Although Universal City has just been completed, it has traditions of hundreds of years ago. Its buildings, both great and small, are built on Mission and Spanish lines and are extremely attractive in



appearance. The smaller buildings, which are used for picture producing purposes only, are simple front exteriors which are erected in a day and are torn down just as soon as they have served their purpose. Expensive street scenes are built for a single picture and then torn down. In many instances the cost of preparing elaborate settings aggregates thousands of dollars.

THE "MOVIE" WEATHER MAN

The name, "The Movie Weather Man," has been given to the head camera man of the Universal Film Manufacturing Company in Southern California. The reason for this is that he is the creator of the "Don't Shoot" flag, which in this instance regulates the operations of twenty or more camera men employed by this concern.

Throughout the past winter the weather and lighting conditions in that southern section have been anything but favorable to the motion picture business; that is, when compared to the same months in other years. The days have been cloudy and hazy and a great number of the pictures that were made under these unfavorable weather conditions proved unsatisfactory for distribution. A poor strip of film means quite a loss to the picture company, for it does not simply mean the loss of the film and of the camera man's time, but of the loss of the entire company which made the picture and of the scenery men, for the scenes have to be rearranged and the picture retaken.

The "Don't Shoot" Flag Has Much Significance to the Camera Men of Universal City. It is Displayed When the Weather is Not Suitable for the Taking of Motion Pictures.

GRIFFITH BEGINS WORK ON ANOTHER GIGANTIC FEATURE

Much speculation is rife in filmland as to what will be the subject of the next feature photoplay to be produced by David Wark Griffith, who recently returned to the Reliance-Majestic (Mutual) studios in Hollywood, Cal., after a long sojourn in the East, where his masterpiece, "The Birth of a Nation," is being presented.

It is said that he has under consideration plans for the production of "The Quest of the Holy Grail," suggested by the famous frescoes of Edwin Austin Abbey, that adorn the walls of the Public Library in Boston.

Reproduction of these frescoes is controlled by Mrs. Abbey, widow of the noted artist, and negotiations are being made with her and her brother-in-law, Charles Scribner, the New York publisher, who manages her affairs, for the rights to photograph the frescoes.

If you enjoy THE WORLD'S ADVANCE, please tell others; if not, write us your reason. Have you any suggestions to make?

The Technique of Photoplay Make-Up

"YOU cannot use much make-up for the movies. Particularly is this true if the pictures are made indoors, under the searching studio lights. Then rouged lips take on the color of uncured ham and beaded eyelashes become a cross between a king's moustaches and a porcupine's bristles. So usually we have to go it alone, with nature only slightly aided."

It was Miss Fan Bourke talking — Fan Bourke of Mutual Film stardom in drama and comedy. If any one should know thoroughly the technique of photoplay make-up it is Miss Bourke. For, if there is any rôle she has not played — from comedy scrubwoman or dog-catcher's bride to heavy villainess or sweet-faced madonna—it is solely because somebody in the studios failed to awaken from his torpor and wish the part on her. Wherefore we asked Miss Bourke, who used to be on the speaking stage and therefore knows the technique of both the spoken and the silent drama, to tell us some more about motion picture make-up.

FAN BOURKE, MUTUAL FILM STAR.

Above, as she is off stage. At the Left, in tragedy. At the Right, in an ingenue role. Below, in farce comedy.

(Photos. by Bangs, N. Y.)

"A girl who wants to become successful in motion pictures," said Miss Bourke, "has to start out with a few natural adornments. But these are not always the adornments that make men gaze upon her or women envious of her. Because a girl 'screens' well, as we call it, is not saying that she is easy to look at.

"On the contrary, there are many favorite photoplay actresses who, out of their films, are not beautiful except in the sense that they are interesting of appearance and intelligent of expression. Blue eyes that are of the prettiest in the drawing-room or on the street may be wholly inadequate for the sternly scrutinizing eye of the motion picture camera. A mouth whose lines

carry their own sweet messages may look on the screen like a torn pocket.

"To some extent we can with make-up remedy certain small defects of shape and color in the features. We even can turn a naturally bad line into a distinct asset.

"Now, as I see it, the spoken drama, pantomime and motion pictures are three distinct and diverse arts. Too often motion pictures are considered part of the pantomimic art. Nothing could be further from the truth. And so motion picture make-up is as distinctive as motion pictures: it is predicated upon one's methods of before-the-camera acting.

"Assuredly, success in motion picture acting depends on one's ability to think one's rôle so hard that it fairly exudes through the pores of the face. One thinks it hard against the inside of one's forehead (yes, it is as physical as that) and forces the idea against and through the camera lens. I think the success of directors like Griffith, Ince, Fleming and others of their class hinges on their ability to get their actors to do this.

"I have tried the plan, and it seems to succeed—for me, anyhow. I never use much make-up (fortunately, I have just enough natural color in my skin to overcome the green of the studio lights). But I do have to think my rôle and the lines I would be saying were it a speaking part as hard as ever I can, so that my eyes will look my thoughts and the lines of my mouth will echo my eyes.

"To be sure, one may accentuate a heavy dramatic or a farcical rôle by some trick of garb or hairdress. But all such trickery should but frame the face and the thoughts behind the forehead. The motion picture is not an X-ray machine, but it comes pretty close to photographing through the forehead the ideas behind it."

USING A BATTLESHIP IN A PHOTOPLAY

In the recent Lubin production entitled "The Insurrection," one of the scenes shows an American battleship bombarding a South American town where revolutionists are about to massacre all the Americans, as well as blow-up American vessels in the harbor.

The production of this unusual scene called for considerable preparation. To begin with, Director Terwilliger asked for, and succeeded in obtaining, permission to take scenes on board the battleship *Alabama*. He also was granted permission to fire a special light shell from one of the big 13-inch guns mounted by the warship. The shell was of special design and filled with a chemical capable of emitting an intense flash of light. It was constructed in the Lubin shops.

The climax scene of the film was taken at night. Four powerful searchlights concentrated their rays on the afterdeck, so as to permit the twelve cameras to register the action. Finally, the lights were extinguished at the command of Director Terwilliger and the cameramen continued to crank in pitch darkness. Suddenly the flash of a 13-inch gun penetrated the darkness, followed an instant later by a tremendous flash of light in the distance.

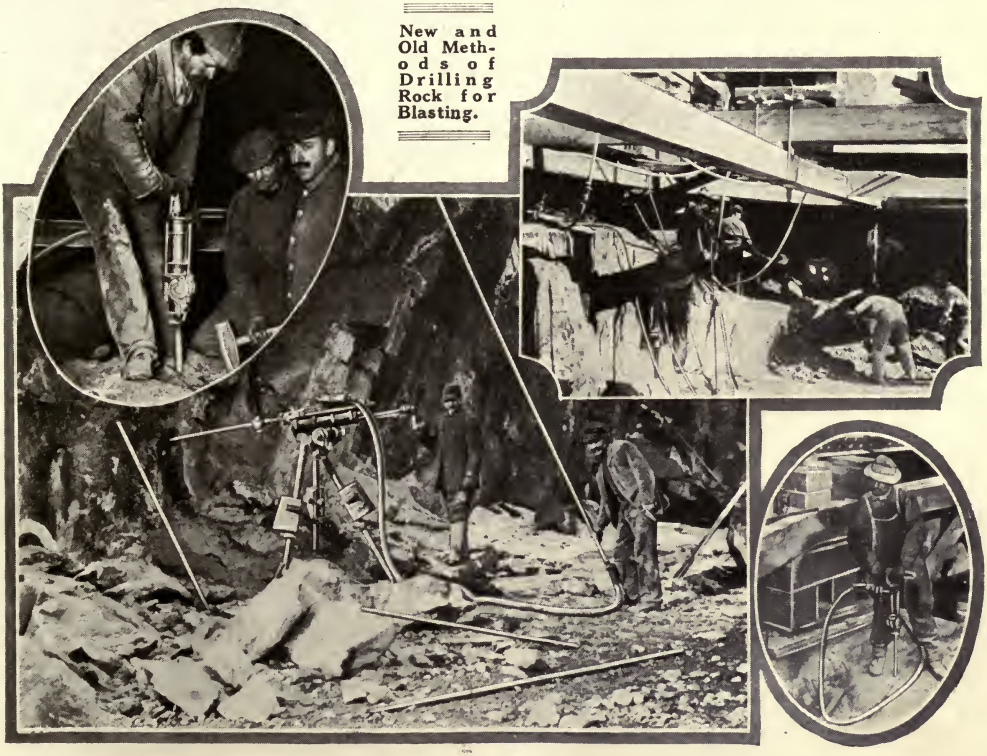
The realistic effect obtained in the finished picture does not fail to momentarily convince the audience that the shell from the big gun has wiped out the band of revolutionists who threatened the Americans.

NEW ANIMATED CARTOONS

A cartoon comedy, drawn by Carl Francis Lederer, of a somewhat different sort, and introducing a droll addition to the pen and ink creations of the screen, was released by the Lubin Company recently. The comedy is called "Ping Pong Woo." Ping is a Chinese urchin whose grimaces and gyrations are extraordinary examples of the camera's power to make a line of ink seemingly take on life.

HIGH SPEED REPLACES WEIGHT IN DRILLING ROCK

Quite a contrast in methods of excavating rock is furnished by the construction of the new subway system in New York as compared with the first New York subway, which was completed in 1904. In the former case practically all the rock was drilled by means of heavy reciprocating drills mounted on heavy iron tripods. Weight was the predominating factor—the apparatus was heavy and the blow was heavy, but the speed of operation was correspondingly slow; in fact, the apparatus was so cumbersome that it frequently required as much time to set up the drill as to drill the blast hole.



New and Old Methods of Drilling Rock for Blasting.

Hand drills without any mounting whatsoever are the principal means adopted for cutting the rock in the new subway. These little drills, known as Jackhammers, represent the other extreme. They weigh from forty to ninety pounds, depending on size, as against a total weight of from 500 to 1,000 pounds for the mounted type. The strange feature about these little drills is that, in spite of their size, they make faster progress than the heavier type. The secret of their great cutting speed is due to a number of factors. In the first place they strike three or four times as many blows per minute. The cutting steel does not reciprocate, but rests against the rock while a rapid succession of hammer blows strikes its upper end. At the same time the drill automatically rotates the steel and blows a jet of air down the hollow steel so as to eject the cuttings and constantly present clean rock to the cutting edges.

Furthermore, the dead time formerly consumed in setting up and adjusting is entirely eliminated with the new type of machine, as it requires but an instant to apply the drill to any spot desired, and the drill can be used conveniently in all sorts of out-of-the-way locations where cutting by any other method would be extremely difficult to accom-

plish. It is a common sight to see dozens of these little drills at work at all places where the excavations are open, and their peculiar humming sound may be heard all along the subway route where the workings are uncovered.

HOME-MADE AUTOMOBILE SHOWS MUCH INGENUITY.

Much ingenuity has been displayed by the driver of the automobile shown in the

Although Built from Odds and Ends, this Automobile Affords Much Pleasure to its Owner.

accompanying illustration. During his spare time he succeeded in constructing this vehicle from odds and ends. The automobile is capable of carrying his entire family and compares favorably with most manufactured cars in general practicability.

GLASS COOPS INCREASE POULTRY PROFITS.

The results of raising and keeping chickens in coops equipped with glass windows are eggs and plenty of them, according to a man in New Mexico who has experimented along these lines.

The chicken coops are made of ordinary ⅞-inch lumber of the dimensions 3 by 6 by 2 feet 4 inches high; that is to say, the coop is two feet high and rests upon a four-inch foundation. In the foundation a partition is made directly in the middle; a board floor three feet square being placed over one-half the coop floor space, while the other half forms a dirt floor, where grain of any kind can be sown for scratching. On the board floor is placed a quantity of litter under which grain is scattered at night, so that in the morning the fowls will scratch for their breakfast. The grain sown in the dirt is also scratched for, and what is not found will sprout, so that none of it is wasted. By this system of coops and feeding the hens have to work for every bit of grain they get, and it is this compulsory exercise that produces the results.

The coops were tried out two years ago by placing five pullets in each, and during the winter four or five eggs a day were secured from each coop. This rate continued, although the thermometer went down to 17 degrees below zero. Last December fourteen hens were kept in these coops, with a return of 32 dozen eggs for the month.

In addition to the grain, the hens receive plenty of fresh water, charcoal, grit and oyster shells, as well as a dry mash composed of one part each of wheat

Increased Poultry Profits Are the Result of the Use of Glass Chicken Coops.

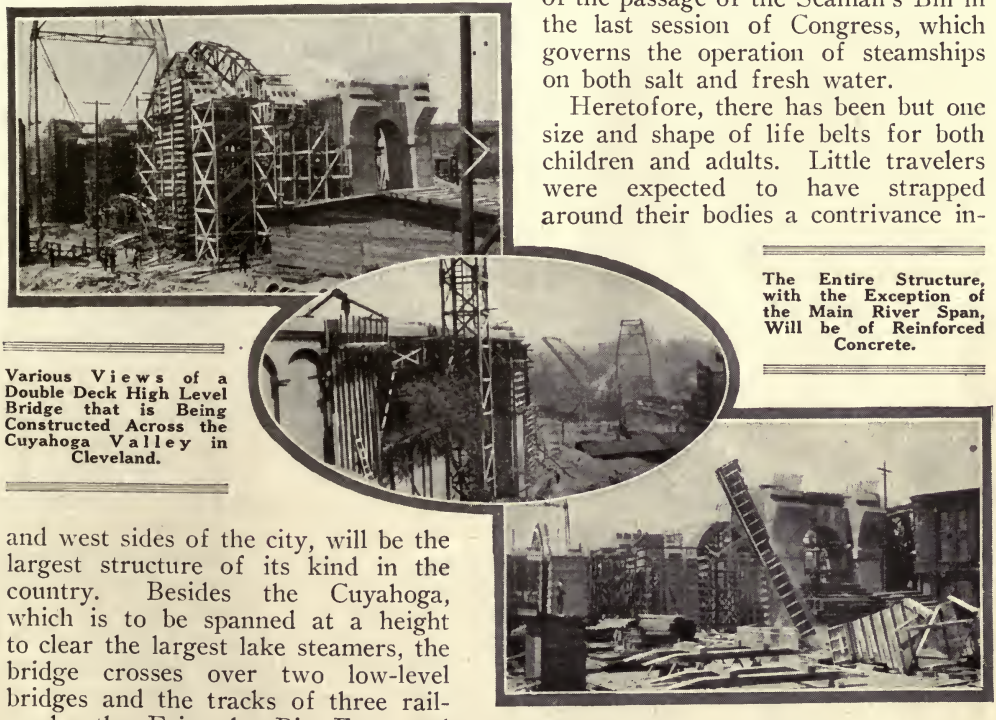
bran, alfalfa meal and whole oats, while a little fresh beef scraps go into the coops once a week. Green stuff in addition to the sprouted grain is also supplied.

The top of each coop can be raised to any desired height to admit air, the chicken wire cover preventing the hens from escaping. The glass sides of the coops are turned to the south in winter in order to secure plenty of heat, but in summer they are turned to the north and

the coops are kept in the shade. With the glass acting as a hothouse, the chickens keep warm even in winter weather, and the animal heat keeps them comfortable even though the top of the coop is open a little for ventilation.

A DOUBLE-DECKED CONCRETE BRIDGE

The double-decked, high-level bridge which is being built across the Cuyahoga valley in Cleveland, connecting the east and west sides of the city, will be the largest structure of its kind in the country. Besides the Cuyahoga, which is to be spanned at a height to clear the largest lake steamers, the bridge crosses over two low-level bridges and the tracks of three railroads—the Erie, the Big Four and the Baltimore & Ohio.



Various Views of a Double Deck High Level Bridge that is Being Constructed Across the Cuyahoga Valley in Cleveland.

The Entire Structure, with the Exception of the Main River Span, Will be of Reinforced Concrete.

The entire structure, with the exception of the main river span, will be of reinforced concrete. There will be twelve concrete arches averaging 140 feet in length, and the west and east approaches will be 386 and 230 feet, respectively. The concrete arches will be reinforced with 6,000,000 pounds of steel bars and 746,000 pounds of structural steel. The main river span will contain 3,800 tons of steel.

The upper deck of the bridge will be used for vehicles and foot travel. It will have a roadway forty-five feet wide and two fifteen-foot sidewalks. Four street car tracks will cross the lower deck of the structure. The concrete tower pylons will be 145 feet above the ground.

LIFE BELT ADJUSTED TO ANY SIZED CHILD OR ADULT

An adjustable life-preserver has been designed in Chicago as one of the results of the passage of the Seaman's Bill in the last session of Congress, which governs the operation of steamships on both salt and fresh water.

Heretofore, there has been but one size and shape of life belts for both children and adults. Little travelers were expected to have strapped around their bodies a contrivance intended to be worn by the small, middle, and heavy weight men and women.

The new law requires a steamship to be equipped with life belts for both adults and children. In case of an emergency, a child would have to search for a child's belt, while the men and women passengers would have to seek the sizes for grown-ups.

The manager of a steamship line and a mate on one of the boats have jointly contrived an adjustable belt calculated

to fit a body of any girth. It may be adjusted in a jiffy to encircle the waist of a small boy or girl, or any man or woman from the lightest to the heaviest. This is the first known attempt to fashion a life preserver designed to snugly fit the body and allow free, unhampered use of arms and legs in striving to keep afloat until rescued.

MOVABLE SEATS FOR PICTURE THEATRES

It has always been a problem to get in or out of a theatre seat without disturbing persons sitting in the same row or in the rear rows. What promises to eliminate this existing difficulty is presented in the invention of a Seattle contractor. This invention consists of a chair which is so constructed that the seat portion is movable and has a backward play of about 5½ inches. Instead of making it necessary for every person in a row to stand up to allow another person to pass in or out, the new chairs enable the person sitting down to slide back a few inches and thus provide ample room for passing.

No Longer Will it be Necessary for an Entire Row of Persons to Stand Up at a Motion Picture Theatre to Allow One to Pass to and from a Seat When These Movable Seats Are in Use.

PASSERS-BY ATTRACTED BY NOVEL FLORAL DISPLAY

A florist in New York City has hit upon an ingenious way of attracting the attention of passers-by and thus divert customers into his store. His advertisement consists of a window display showing a garden landscape in miniature. From one corner of the window a garden hose is suspended, from which water appears to be pouring forth. Instead of water, however, pieces of string are inserted in the nozzle and lead in all directions over the garden.

TREMENDOUS SPEED CHARACTERIZES NEW AIR BOAT

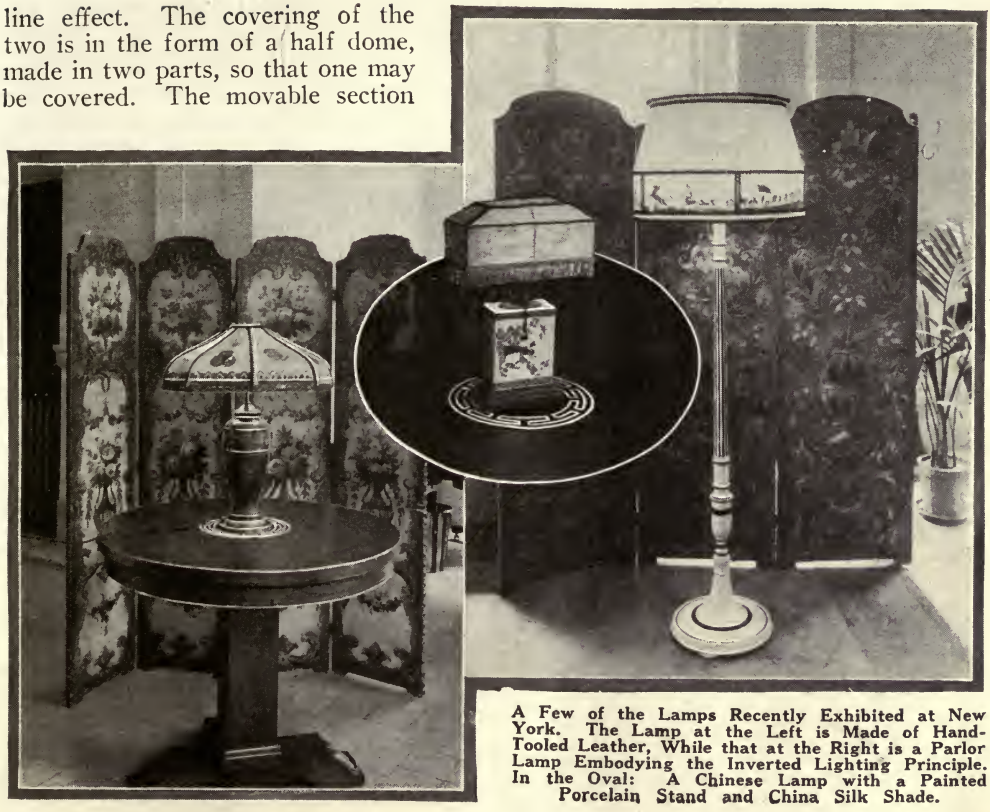
Greater safety and tremendous speed are the important features of a new model hydro-aeroplane which was recently tested by its inventor, Anthony Jannus, of Baltimore. The tests were made over historic Fort McHenry. Seventy miles an hour on the water was made by the new machine on its trial trip, and eighty miles was the speed attained in the air.

Staggered planes are used in the new hydro-aeroplane; the upper plane extending beyond the lower for eighteen inches. By this means the lifting power of the machine is greatly increased.

The uprights used in its construction are markedly different from the usual struts, and are made so as to offer the least possible resistance to the passage of the machine through the air. Whereas on the older models there are sixteen uprights used, this machine has but six, so that air resistance from this source is cut one-fifth. These unique uprights are adjusted to the center of the planes, instead of to the front and rear ends.

The hull of the boat is 25 feet over all, and in it are placed the controls, engine and aviator's seat. The bow of the boat is made so as to produce a stream-

line effect. The covering of the two is in the form of a half dome, made in two parts, so that one may be covered. The movable section



A Few of the Lamps Recently Exhibited at New York. The Lamp at the Left is Made of Hand-Tooled Leather, While that at the Right is a Parlor Lamp Embodying the Inverted Lighting Principle. In the Oval: A Chinese Lamp with a Painted Porcelain Stand and China Silk Shade.

covers a sort of promenade that leads to the passenger compartment. The construction of the hull is quite a deviation from established models. It has a V-shaped bottom instead of the flat bottoms formerly used, permitting the machine to rise more readily from the water.

ORNATE TABLE LAMP COSTS HUNDREDS

Electricity has grown in two opposite directions: It has brought cheap, healthful light to the poor and it has opened up new avenues of expenditure for the rich. A hovel may be wired for a few electric lamps at a cost of five dollars, while the elaborately intricate systems of concealed lighting which are installed in the mansions of the wealthy cost thousands of dollars. A highly ornate table lamp was recently shown at an exposition in New York which was worth $250, and a hand-tooled leather screen which served as a background, $250 more. Exhibited with this lamp were others ranging in price from $6 to more than $250.

CURIO DEALERS ON EUROPEAN BATTLEFIELDS

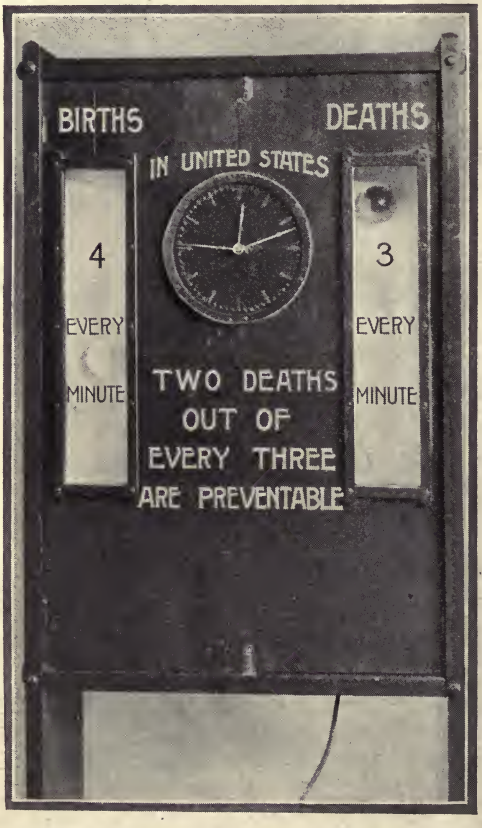
The most numerous visitors on the battlefields of Europe are the curio dealers of the belligerent and neutral countries. These men are endeavoring to buy trophies of all kinds which they believe in time will be valuable. In Belgium these dealers have bought articles for next to nothing and which at the end of the war will be worth a fortune. Fanciers who secure such trophies hold them for high prices or will not sell them on any consideration.

A bookseller during the American Civil War made his fortune in collecting

and selling trophies. When the cargoes of the blockade runners were sold at auction in the harbor of Hamilton this book dealer bought a number of package cases without the least knowledge of their contents. These turned out to be boxes of old brass buttons on their way to the Confederate headquarters for use on the uniforms of the southern soldiers. This man made his fortune on these buttons which he bought so cheaply.

A CLOCK THAT INDICATES BIRTH AND DEATH RATES

An unusual device intended to illustrate the national carelessness in the matter of preventable deaths has been built for the exhibit of the National Conference on Race Betterment at the Panama-Pacific Exposition. The device is a clock which, in addition to giving the correct time, also gives a graphic illustration of the frequency of births and deaths in the United States. For every birth—there are four every minute—a white ball ascends the column at the left of the dial. For every death—three each minute—a red or black ball descends the columns to the right of the dial. Of the "death balls," one is black and two are red, indicating that two out of every three deaths are due to diseases which are preventable through proper hygiene and health caution. The clock is operated by electric power, two small motors being concealed among the works of the clock. The added functions of the time-piece do not disturb the time-keeping excellence of the strange clock.



Unique Clock Which is Being Exhibited at the Panama-Pacific Exposition and Serves to Indicate the Number of Births and Deaths in the United States Every Minute.

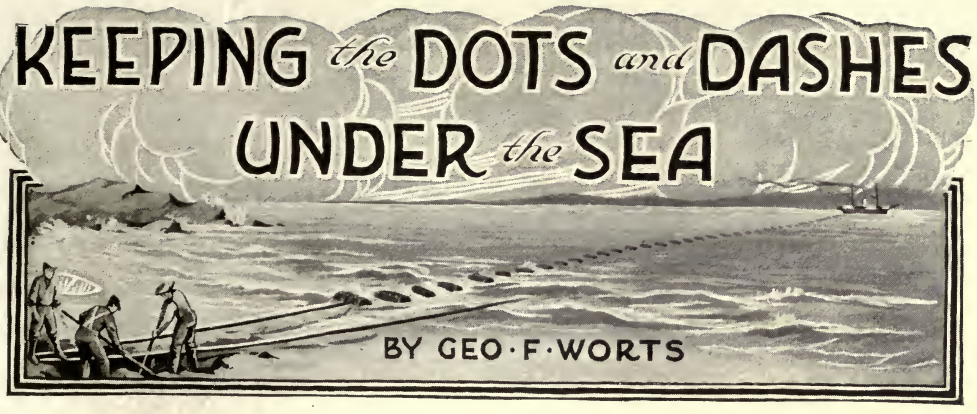
NAVY DRY DOCK REPRODUCED

Among the many instructive exhibits in the Palace of Manufactures at the Panama-Pacific Exposition is to be found a very complete model of Dry Dock No. 4, located at the New York navy yard. This model was constructed under the supervision of a corps of civil engineers of the United States navy, and is particularly instructive because it shows the arrangement of the materials and the construction of the hidden parts of the dock.

NEW FIELD FOR RADIUM

Since great physicians began experimenting with radium as a cure for cancer, mankind has placed far greater importance on its future and every possible means is being tried to make its production cheaper and easier. In view of these facts, scientists are much interested in the announcement that Dalavit, on Loch Lomondside, in Scotland, is to be the home of a new radium industry. John S. MacArthur, a noted metallurgical chemist, it promoting the plan, and he believes the cost of the product can be lessened materially.

KEEPING the DOTS and DASHES UNDER the SEA



BY GEO·F·WORTS

ONE puncture the size of a needle in a three thousand mile length of submarine cable would sever the ties that bind continents. The utmost care must be observed in the manufacturing, the laying and the repairing of cables. Every step taken is the result of exhaustive scientific research, of the rigid guidance of experienced engineers — for millions of dollars are staked on the success or failure of the tiny thread of copper which reaches out under the sea.

BECAUSE a whale became entangled in a submarine cable, one of the arteries through which throbbed the life of two continents was severed. That is just one of the contingencies which may arise to test the resourcefulness and the daring of the "trouble shooters of the depths." Another time, a hungry tiger shark bit deep into the gutta-percha insulation and let the dots and dashes leak out into the sea. But before relating any further mishaps, let us turn to a few of the interesting incidents in the career of a submarine cable which leads to the point where the first-aid-to-the-injured services of a repair ship are required.

The War and the Cable

Before hostilities began in Europe, 322,000 miles of submarine cable were in operation—more than enough to encircle the world a dozen times. It would be difficult to say just how many miles have been destroyed or rendered inoperative by the warring powers. Raising a cable in shallow water and cutting it, if its approximate location be known, is a comparatively simple matter. But it is a much easier matter to steam into an unguarded port, where a cable station is located, and destroy the instruments, as did the German cruiser *Emden,* for instance, at Discovery Island. Then, too, a cable may lie between two hostile nations, Germany and Great Britain, for example; needless to say, the Anglo-German cables will lie idle until the war is over.

Submarine cables owe their successful existence to the fact that gutta percha, a form of rubber gum, has high electrical insulating qualities, and, like the cypress, will deteriorate if it is not submerged in water.

Gutta percha is the sap of a curious tree found in the Malay and Sunda Ar-

chipelagos, off the southeast coast of Indo-China. It is drawn from the trees as a thin, milky fluid, which soon discolors and rapidly becomes thick and gummy.

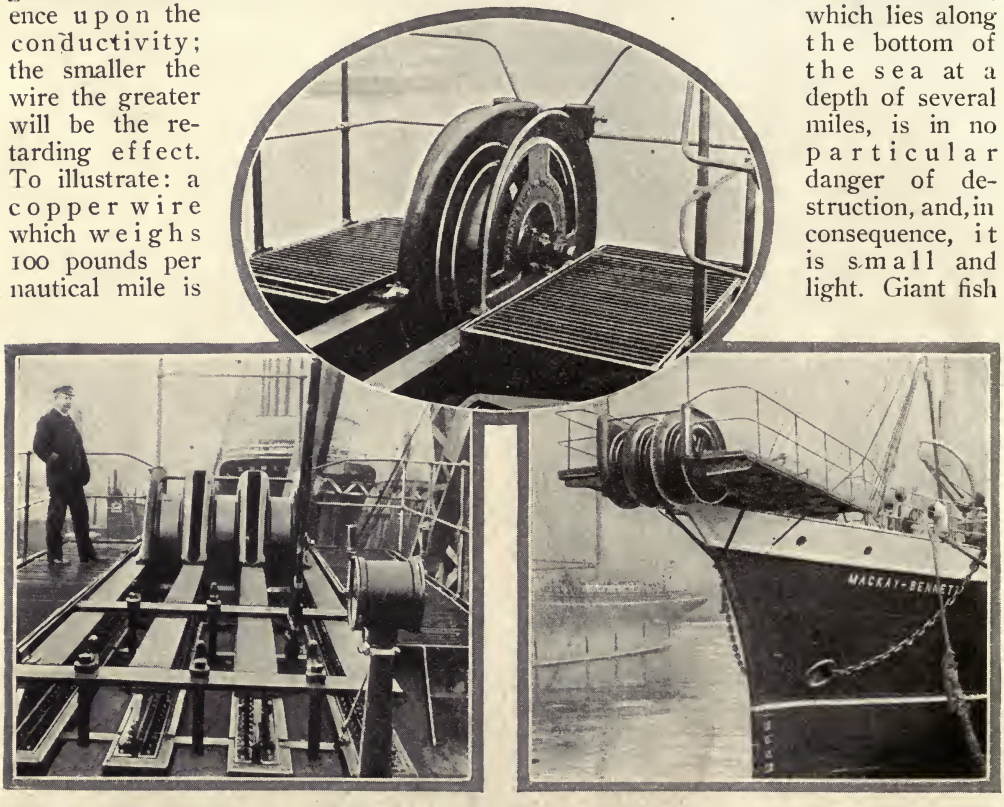
The Heart of the Cable

The copper wire which forms the core of the cable must be the purest obtainable, or the flow of electricity will be retarded, and the efficiency greatly lowered. The size of the wire has quite as great an influence upon the conductivity; the smaller the wire the greater will be the retarding effect. To illustrate: a copper wire which weighs 100 pounds per nautical mile is not nearly so conductive as one which weighs 200 pounds. In several of the modern Atlantic cables 700 pounds of copper are used every mile.

Early in the career of electricity the discovery was made that a conductor made up of a number of strands of fine wire possessed far more strength than a solid conductor of the same weight. Consequently, the stranded core, in spite of its greater cost, has been universally adopted.

Although there is no particular reason why the bulk of submarine cable should not be made in America, it is manufactured almost exclusively in Europe. Giant machines are used in stranding the cores. As the wire emerges, it is coiled in three-mile lengths on huge drums. The process is completed by coating the copper with an insulative and a protective covering of gutta percha and metal.

The cable, which lies along the bottom of the sea at a depth of several miles, is in no particular danger of destruction, and, in consequence, it is small and light. Giant fish ordinarily do not penetrate to a depth of more than several hundred fathoms, because of the pressure. Closer to shore, however, the danger from this and other sources is greater.



The Sheaves of the Cable Steamer "Mackay-Bennett." At the Left: The Bow Cable Sheaves as Viewed from Inboard. At the Right: Another View of the Bow Sheaves that are Used for Paying Out and Picking Up Submarine Cables. In the Oval: The Stern Sheaves that are Used for the Same Purpose as Those at the Bow.

Intemperate Workmen a Menace

The shore end of the cable is often

four times as thick as the deep-water type. The copper wires are first wrapped with gutta percha, then brass tape; next, a thickness of jute yarn is applied, followed by a sheathing of galvanized iron wire, more jute, more wires and a final outer covering of jute-steeped yarn. Accordingly, while the deep-sea portion of the cable may weigh no more than 2½ tons per mile, the shore end, armored against icebergs, may weigh 60 or 70 tons.

A deep-sea cable jointer must be a man both temperate and healthy. It seems incredible, but nevertheless it is true, that the exudation of the pores of the skin at the finger tips of intemperate or unhealthy workmen contains harmful secretions which will in time rot the gutta percha.

Above: The Cable Station at Far Rockaway, N. Y. In the Circle: A Commercial Cable Company Operator at His Instruments in the Far Rockaway Station.

Below: General View of the Instrument Room at the Far Rockaway Station. The Messages are Received on Paper Ribbons, Thus Comprising a Permanent Record.

When the cable is completed, it is coiled with the precision of thread in large water tanks aboard the cable ship in readiness for laying. The largest cable ship is the *Calonia,* of London, which was used in laying the trans-Pacific cable of the Commercial Pacific Company. The *Calonia* is 500 feet long, with a capacity of 4,000 miles of cable.

Cables of any considerable length have only one core, as the nearness of two parallel wires in a circuit several thousand miles long would create a powerful electrical disturbance which would interfere seriously with the transmission of messages. The longest cable with two cores is only a trifle longer than five hundred miles. It is laid between Canso, Nova Scotia, and Rockport, Mass.

Surveying the Bottom of the Sea

The cost of laying a submarine cable is enormous, so that the greatest precautions are observed in order that the thin line of copper lying miles deep does not come in contact with the smallest trickle of sea water. In case any of the numerous undersea enemies of the cable should attack the insulation and let the water in, a second necessity arises—that of laying the cable so that it can be drawn readily to the surface for repairs. These two problems are solved, first, by making the cable flexible as well as strong, and, second, by surveying the sea bottom over which the cable will lie.

The geography of the ocean floor is in many respects a counterpart of the topography of dry land. That is to say, there are hills, valleys, plateaus—even an occasional volcano. The question: does a submarine cable sink to the bottom of the ocean? is answered very emphatically in the affirmative. The waters of the sea are never at rest, and a cable spanning two subterranean mountain peaks would

be chafed through in short order. Accordingly, the bottom of the sea is carefully surveyed beforehand, and the smoothest route selected.

These soundings not only reveal the contour of the ocean floor, but they also determine the chemical quality and the temperature, both of which have a decided influence upon the life and the behavior of a cable. If the examinations should prove that the ocean floor contains chemicals injurious to the protective covering, a wide detour is made. The matter of volcanic heat is as interesting as it is troublesome. Heat lowers the electrical conductivity of a wire as well as the insulative ability of the gutta percha; moreover, it shortens the life of that insulation to a serious extent. An ingenious sounding machine, invented by Lord Kelvin, is used for making the surveys.

Landing the Shore Cable

As I have explained, the laying of a cable between two continents does not consist merely of tying one end to a post on one shore, and paying it out while the vessel steams at top speed to the opposite side. The numerous steps of the process are based on long scientific experience, and they are carried out with painstaking attention to the smallest details.

The shore end of the cable is usually landed by means of rafts and india rubber buoys, which are anchored to the bottom. A trench running from low-water mark to the cable hut is dug and the cable laid in it and covered.

When the ship is finally under way, the deck presents a scene of lively interest. The cable is dragged into the water from the storage tanks, like thread from the paunch of a spider. Between the drum and the sheaves at the stern, over which the cable slips into the water, stands the dynamometer. This instrument registers the strain to which the cable is subjected; it is, so to speak, the finger on the pulse of the entire enterprise.

As deeper water is reached the weight of the cable increases, and brakes must be applied to the drum. In 2,900 fathoms, with the ship progressing at the usual rate of eight knots, more than twenty-five miles of cable are in suspension.

If the Cable Should Break!

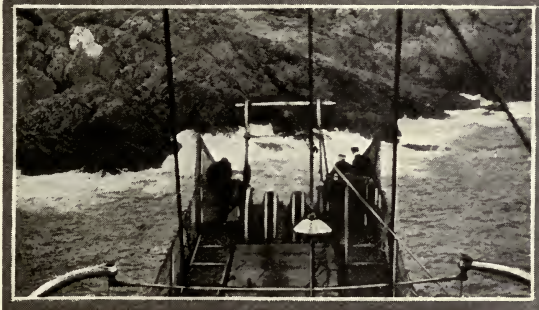
Near the drum from which the black, snake-like reel is uncoiling, the testing room is situated. Here, an expert electrician bends over a table littered with gleaming instruments. An electrical connection is made between the cable and a delicate receiving instrument — the mirror galvanometer. Every fifth minute an electrical impulse is sent out from ashore, and the spot of light of the galvanometer flutters back and forth. As the cable sinks into the freezing-cold water at the ocean bottom, the insulation steadily improves, and the spasms of the point of light weaken until it finally sinks almost to the zero point. A defect in the insulation is indicated by a sudden violence of the light spot, and the repair is quickly made.

When the first drum is uncoiled the vessel is brought to a stop, and the delicate task of splicing the two cable ends is performed. To the observer, an exaggerated amount of pains seems to be taken in splicing a deep sea cable, but every precaution is absolutely necessary. Air holes in the insulation, no matter how tiny, when they are subjected to the enormous pressure of the sea will burst, water will rush in—and the cable will be useless.

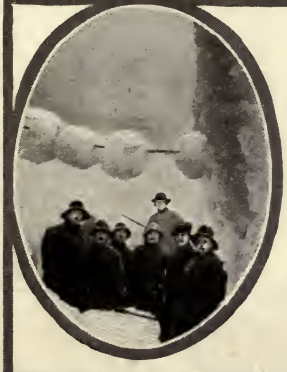
When a storm comes, the odds are heavily in favor of losing a cable. To avert such a mishap, buoys are slung in the rigging ready to be lowered and attached to the broken line at a moment's notice. In spite of this precaution, the cable may snap, as the ship pitches and rears, and slip overboard. Its recovery then resolves itself into a search of long, anxious days—often weeks—and occasionally months. The ocean bottom must be dragged with grappling hooks — a blind, groping, discouraging task. For that reason, very naturally, the shallowest possible route is selected.

During the preliminary surveys for one of the trans-Pacific cable routes, a "valley" nearly six miles deep was sounded, off the island of Guam. The

LIFE ON BOARD ONE OF THE CABLE SHIPS



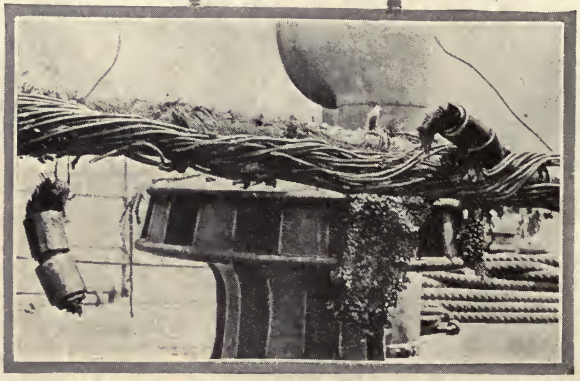
Above: Grappling for a Cable at Close Quarters. As May be Seen in this View, the Cable Ships are Often Obliged to Operate Very Close to the Shore. At the Right: Hooking an Ocean Cable in Order that Repairs May be Made. In the Oval Below: Crew of the "Mackay-Bennett" Breaking Away Ice from the Forecastle.



Above: A Seven-Ton Buoy which indicates the Location of a Cable End. At the Left: The Cable Steamer "Mackay-Bennett."

pressure at that depth is about five tons per square inch, and as it would be quite impossible to recover an injured cable at that point, a wide detour was made. Most of this cable, incidentally, lies in water deeper than three miles.

In the telegraph code the letter "e" is translated into a single dot. The electrical impulse which carries this signal down under the Atlantic, from America to England, consumes, in time, about one-sixth second—an eye-wink—reckoning the speed of electricity at 180,000 miles per second. When the first cable was laid, 500 volts of electricity—enough to drive a street car—propelled the dots and dashes from one side to the other. The life of the cable under that terrific strain was tragically short. It performed fitfully during a brief two months, from August 17, 1858, until the latter part of October. Then the powerful currents, continually seeking an escape, finally broke through the weakened insulation of the cable.



Above: A Section of an Ocean Cable on the Deck of the "Makay-Bennett," Ready to be Repaired. Below: Another Near View of an Ocean Cable, Showing How Damaged the Covering May Become, Especially in the Instance of Cables Near Shore.

The mirror galvanometer, an invention of Kelvin, was then adopted, because only a fraction of the original current was required to operate it—a battery the size of a child's thimble was sufficient—and it increased the speed of transmission six times. Twenty years later, Lord Kelvin, who has been most aptly named "The Father of the Cablegram," perfected the siphon recorder, which prints a graphic record of all messages. Additional improvements came in the form of the automatic printing machine, which entirely eliminates the error of the human equation, and a duplex circuit system which ingeniously permits two messages to go over one wire at the same time. These improvements and others of later origin and lesser importance are incorporated in the majority of present-day cable systems, although the old mirror-galvanometer can still be found in a few out-of-the-way corners of the world.

Hundreds of accidents may happen to a cable to interrupt the flow of conversation between continents. In very deep water the sea bottom consists of decomposed shell matter known as *globigerina ooze*. This substance is harmless, and cables recovered from a globigerinous floor after a repose of thirty years were as sound as the day they were laid. Greater danger lurks in shoal waters. One of the tiniest but most terrible enemies of the cable is the teredo worm; apparently it thrives on a diet of gutta percha! The attacks of

the teredo are repulsed with a thin sheathing of brass. A more inert but none the less virulent enemy is the chemical iodine, which is a by-product formed in the maturation of sea-weed. Iodine rapidly corrodes the armoring wires of the cable.

In the Pacific, where the sea bottom occasionally displays the acrobatic ability of rising and falling a few miles overnight, a submarine cable leads a life of extreme uncertainty. Volcanic eruptions, which will burn a cable completely in two, although not frequent, are a constant potential danger.

The shore ends of all cables are regularly subjected to the strain of surging water; tides, storms and the general restlessness of the sea—the "ground swell," as it is called—all contribute. Anchors of vessels, wrecks and icebergs are a constant menace.

The Trouble-Shooters of the Deep

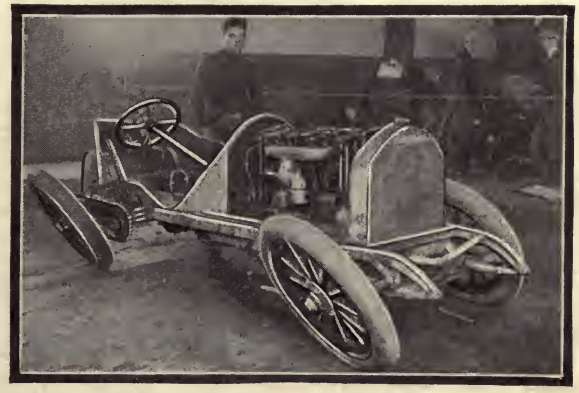
The exact location of a puncture in a cable is found with delicate electrical testing instruments which are connected at either end. The latitude and longitude are immediately given to the commander of the cable ship, and he steams post haste to the zone of trouble. The bottom of the sea is dragged, the cable pulled to the surface, and the repair quickly made. Unfortunately, cables usually break during the heaviest storms of the year, and the task of the trouble-shooters demands the highest qualities of fearlessness and skill. The *Mackay-Bennett,* during one spell of bad weather not long ago, remained at sea three months in the endeavor to make a single repair. She was repeatedly blown hundreds of miles away from the ground of operations.

In conclusion, the fact may be again emphasized that putting a submarine cable under the sea is by no means a haphazard proceeding. Every step is the result of years of experience, of the tireless planning of scientists, of the rigid guidance of skilled engineers—to insure the millions of dollars that are staked on the ability of the slim line of copper to carry the voices of the nations to the ends of the world.

THE WORLD'S OLDEST RACING CAR

In the accompanying view may be seen the oldest racing automobile in the world. It is the Fiat Tornado last used by Louis Meneghetti, and the illustration shows the car as it was picked up from a short, circular dirt track in a western state. A Richmond (Va.) capitalist now owns the car, which has undergone extensive repairs, and it will be seen on some of the well-known tracks during the next season.

Meneghetti, before he was killed, said this car could not over-turn on a short track if it were properly controlled. He gave that reason for his triumphant success with the car in South America. But the car did over turn, despite the slant of the wheels which was intended to overcome the tendency of an automobile to fall over when taking curves at high speeds.



The Slanting Wheels of This Early Racing Car Were Intended to Prevent Overturning—But They Did Not.

Safer and Better Motion Pictures

By Robert G. Skerrett

HEREAFTER, according to a recent invention, it will be possible to show moving pictures in broad daylight, and there will be no further need to darken the places in which "movie" entertainments are given. The spectators will be able to sit in a brightly illuminated room or out-of-doors, and there will be no necessity for that gloom which has proved itself in the past a cloak for a variety of questionable ends.

The new invention certainly promises to revolutionize the art in more ways than one, and its most striking feature is extreme simplicity. At present, an opaque screen or kindred white surface forms the reflector by which the illumined image is cast back into the eyes of the spectators. The picture is projected against the screen from some point in the midst of the audience; the reflecting surface absorbs a considerable percentage of the light; and what is left is made seemingly bright by darkening the surrounding space. It is a contrast that would not exist if the place were otherwise illuminated. But this is not the only handicap to successful motion pictures under present conditions.

If the patron of such a theater has been unfortunate enough to get a seat well off to one side he sees the screen at an acute angle, and all of the images are unpleasantly foreshortened. Only the spectators in the middle of the theater, and these, of necessity, are comparatively few, escape this distortion. Again, the contrast between the shimmering pictures and the enveloping gloom hurts the eyes. Mr. John F. R. Troeger has disposed of these difficulties by means of a translucent screen of novel construction, and at the same time he has provided other betterments through its use.

To-day there are at least 19,000 moving picture theaters in the United States, and the attendance numbers every twenty-four hours something like 17,000,000 persons. Every once in a while we hear of a fire or a panic in a show of this sort, and the peril is directly due to the presence of the machine and its inflammable reels right in the body of the house and among the audience. The reflecting screen is at the bottom of the menace. It was to overcome this danger that Mr. Troeger spent a long time in hunting for a suitable material for a translucent screen, for he wanted to make it possible to place the picture apparatus in a fireproof annex at the rear of the theater, back of the stage, from which the images could be thrown through a small hole in the intervening wall.

As he says, "It will thus be clear that I have provided a screen which may be disposed between the projecting machine and the spectators, upon which the picture may be cast so that the rays of light pass directly from the machine to the audience, thus increasing the intensity of the light and making the image visible day or night. By reason of the novel formation of the screen, the picture stands out in relief and is much more lifelike than kindred images heretofore exhibited." How is this?

The translucent screen is ribbed vertically on its front face, and these corrugations are virtually prisms, so that the refracted beams are bent well to the right and left, as well as projected directly ahead. The first effect of this is that there is very little of the distortion due to foreshortening which is so noticeable with the ordinary screen—the spectator well off to either side has substantially as perfect a picture as his fellow sitting in the middle of the hall. But this does not explain the feature of improved relief now not possible with the usual apparatus and the commonly-employed reflecting surface.

A photograph is flat because it reproduces the picture impressed upon a single objective. The sense of depth which we get in looking at objects is due to the employment of two eyes and

the fact that each orb sees the scene from a different point. These double images are blended and produce a single impression upon the mind. This is what is called the stereoscopic effect of double vision. Mr. Troeger eliminates the flatness of the ordinary moving picture by means of his screen's vertical ribs. These prisms give slightly overlapping or double images, and the result is a sense of realism and depth, as the eyes interpret them.

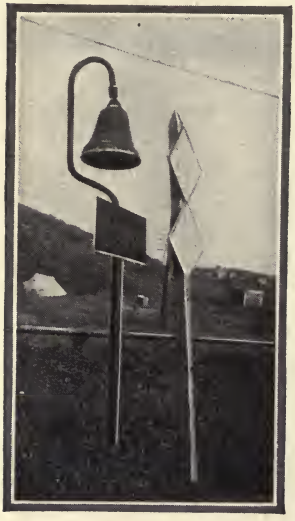
Two Views of the New Motion Picture Screen and its Inventor.

The inventor's first aim was to obtain a material with just enough faint cloudiness to catch the light beams and to reproduce the picture, yet sufficiently translucent to allow the rays, but feebly dimmed, to pass right on through to the eyes of the observer. After much experimenting, Mr. Troeger found that he could build up the desired translucent substance upon a suitable foundation of silken mesh, and now he can make in this way screens of any size. Up to date, the largest he has turned out are 18 by 20 feet.

Apart from the ordinary field of entertainment, he now looks to daytime advertising as a further direction of valuable employment. Where electric signs serve their purpose only after nightfall, movies, designed for the same end and using the Troeger screen, could be effectively displayed at any hour. Open-air shows, that cannot now begin until dark, may operate early and late to the advantage of both the public and the proprietors. The public lecturer should find this new screen a great aid, for instead of talking into a darkened hall he will hereafter be able to see his audience and to respond more sympathetically to the mood evidenced by their faces. In educational work, much may be gained by the improved sharpness of the pictures and, for students engaged upon technical subjects, exact reproduction is very important. As we have seen, the screen eliminates or greatly reduces abrupt foreshortening.

THE EL CAMINO REAL BELLS

The El Camino Real bells are a feature of the motor travel through California. In the olden days when the Spanish government was in control of the section now known as California, a winding road led from the northern to the southern limits of the state, and still farther. At that time this road was known as the El Camino Real, or The King's Highway. This was the thoroughfare which connected the various missions of California, and it was along this road that Anna B. Pitcher established refreshment and rest rooms. During the past few years this road has been transformed from the crooked, winding cow trail to a comparatively straight boulevard, improved under the most modern methods. In making this boulevard care was exercised to deviate as little as possible from the original highway. In order to retain the idea of this road being first cut by the Spanish, and also to remind travelers that this was the original Mission road, hundreds of bell-like indicators have been erected, one at each mile point. Divergent and cross roads and also historic objects and points are indicated on the metal sign of the bell post. The distance and directions to various towns and cities are also indicated. The series of El Camino Real bells extends from San Diego to Sonoma, in Sonoma county, and lends an atmosphere of distinct attractiveness to the famous highway.



Hundreds of Bell-Like Indicators Dot the Original Mission Road of California.

ANCIENT CHINA AND MODERN ELECTRICITY

It is a sign of the progress of the Chinese people that on the grounds of the Chinese exhibit at the Panama-Pacific Exposition the modern electric globe is applied as a source of light for the ancient Chinese lantern. Beside the miniature Ancient Wall of China and the curiously beautiful examples of Far Eastern architecture stands a strictly American lamp post from which is suspended a beautifully marked Chinese lantern, electrically lighted—the only sign of advancing civilization in the Chinese exhibit.

A PIONEER AMERICAN LOCOMOTIVE

One of the most interesting of old-time American locomotives is the "Atlantic," the second locomotive used on the Baltimore & Ohio Railroad. This engine was built in 1832 by a watchmaker named Phineas Davis of York, Pa., who also constructed the "York" one year previous, the latter being the first locomotive used by that railroad. Along with some forty odd locomotives, among them many historic ones such as the "Thomas Jefferson," "Mt. Vernon," "Mississippi" and the "Sandusky," the "Atlantic" has been stored in the shops of the railroad at Martinsburg, W. Va., since the St. Louis Exposition.

The Second Locomotive Used on the Baltimore & Ohio Railroad.

MEDICAL ELECTRICITY'S LATEST TRIUMPH

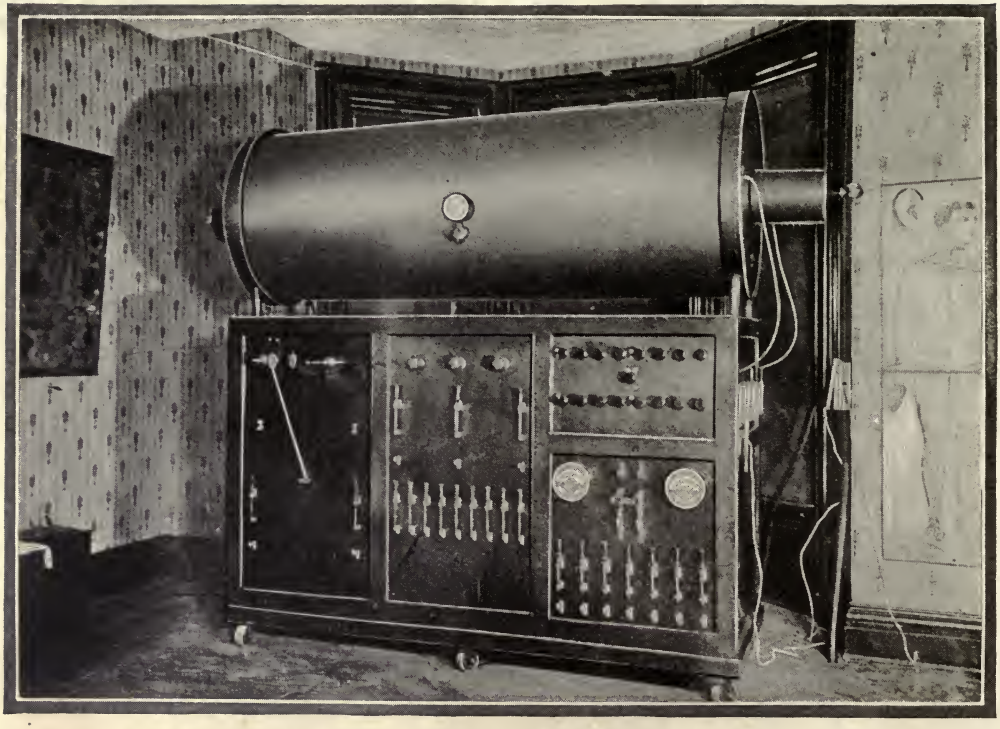
By THOMAS STANLEY CURTIS

THE tendency in the development of X-Ray apparatus has been largely in the direction of greater power and penetration in order that the exposure required for a radiograph of the heavier portions of the body might be reduced to a minimum. Little has been told the public of the efforts expended to make the Roentgen ray safe—to reduce the danger of the horrible burns so prevalent in the early days of the art. Within the last month comes an announcement of a new type of apparatus which, according to its inventor, combines the features of power, speed and safety to an astonishing degree.

"MY apparatus generates a burnless X-Ray." Such was the simple and direct answer to his first question when the author called on Charles H. Stanley at his New York laboratory in search of particulars relative to the new electro-therapeutic apparatus that the little bird had whispered was to be found at a certain address. Realizing, of course, that a statement fraught with such tremendous importance was not to be taken at its face value, the inventor immediately proceeded to elucidate.

In response to the natural inquiry as to why his new ray did not exhibit the burning tendencies of the familiar X-Ray, Mr. Stanley instantly came back with the question, "Why does the conventional ray produce these burns?" Frankly, we did not know beyond the fact that the action of the X-Ray is destructive to the tissues when applied in dosages above a certain degree. Just why it is destructive we are not at all certain. Permitting his visitor to reach this obvious and rather unsatisfying conclusion, and without offering any further light on the subject, Mr. Stanley led the way to the room in which his apparatus had been installed.

"Here," said the inventor, "is a machine which takes its current from the central station mains at 220 volts pressure with a frequency of 60 cycles per second, and which delivers to the X-Ray tube a current of enormous voltage and at a frequency well into the millions." The machine, if such it may be called, proved to be a monster high frequency coil. The lower portion which houses the transformer, condenser and spark gaps is some ten or twelve feet in length,



The Stanley X-Ray Apparatus: High Tension Transformer and Switchboard Producing and Controlling the Current for the X-Ray Tube.

half that in height and perhaps a third in thickness. Upon the front of this case are mounted the switchboards of highly polished black glass with their myriad of meters, control knobs and levers, knife switches, and other instruments, all in shining copper. Surmounting the lower cabinet is a gigantic cylinder resembling the familiar induction coil in general appearance. It is from this latter cylinder that the useful current is obtained.

While the inventor did not make clear in technical terms just wherein his apparatus differs from the modern high frequency outfit except in point of size, still, credit must be given him for a truly wonderful system of control which enables him to utilize to the fullest extent the possibilities of the oscillatory current, not only in X-ray work, but in the general practice of electro-therapeutics. The inventor claims for his coil some very broad ranges of frequency and voltage, as well as volume of current administered.

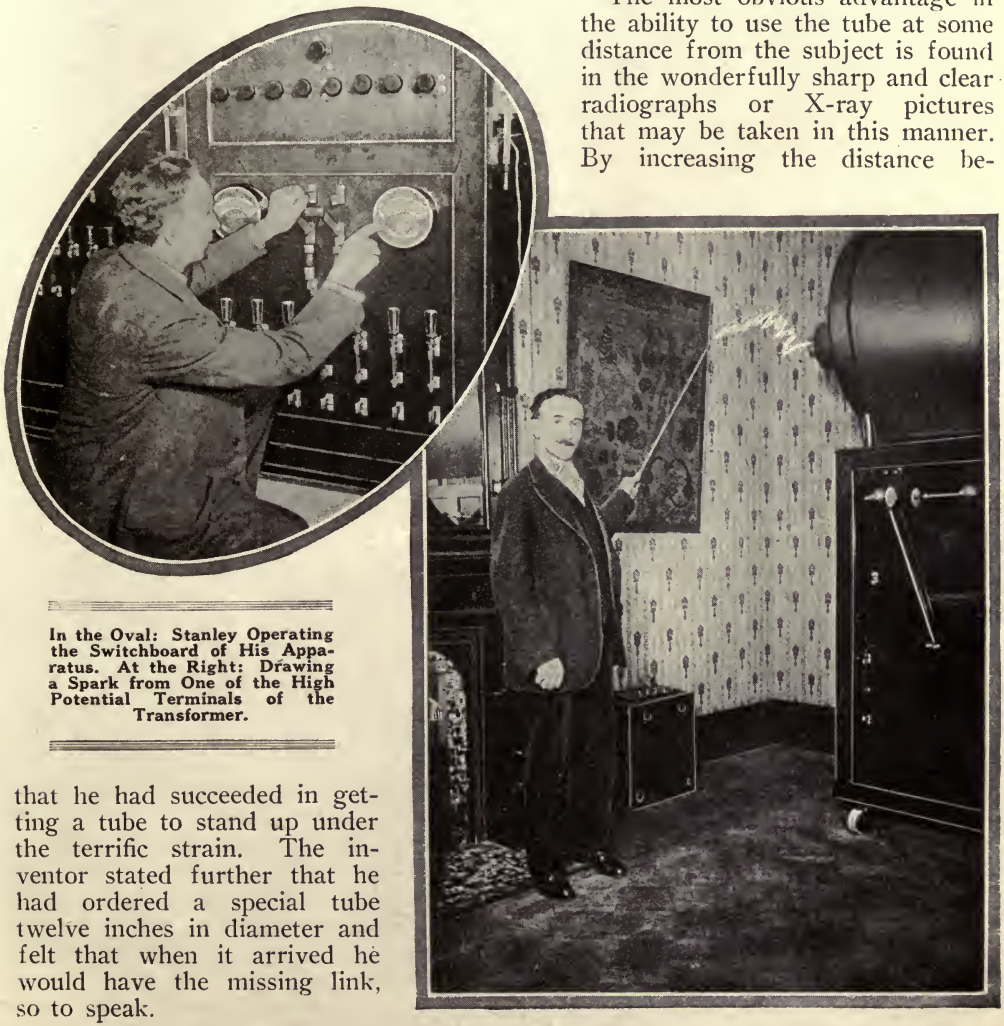
Proceeding with his explanation of the theory upon which his ray is based, Mr. Stanley went on to point out that practically all efforts in the past few years have been directed toward the reduction of exposure and the production of more powerful apparatus in order that the penetrative properties of the X-Ray might be enhanced. The tendency in this direction has led to the evolution of special transformers to deliver a comparatively heavy current at a moderate voltage to a tube built to stand the added volume with its attendant heat. Mr. Stanley has gone about the problem in a different manner, his theory being that a current of exceedingly high potential and high frequency put through a specially designed tube will give the desired penetration and speed without the danger of burns. Working on this theory, the inventor has experimented, so he states, for the best part of fifteen years and during the past five years he affirms that his hands and body have been exposed, sometimes for hours at a time, to the most powerful rays from his tubes. A

close scrutiny of his hands disclosed not the slightest symptoms of the familiar *dermatitis,* and, as the inventor remarks, "The proof of the pudding is in the eating."

Some small experience in connection with the use of tubes on very high voltages prompted the visitor to inquire whether or not the inventor had experienced any difficulty with punctures when operating the tube at great potentials. To this Mr. Stanley replied that in this very direction was to be found his chief obstacle. In the early days of his experiments, he stated that he had punctured one tube after another and it was not until within the last few years that he had succeeded in getting a tube to stand up under the terrific strain. The inventor stated further that he had ordered a special tube twelve inches in diameter and felt that when it arrived he would have the missing link, so to speak.

The demonstration of the apparatus served very largely to dispel the inevitable doubt that had formed itself in the visitor's mind. The apparatus beyond any question exhibits a remarkable penetration. Fluoroscopic examinations can be made at a distance of thirty feet from the tube, and when the apparatus was placed at a distance of six or seven feet from a heavy oak door, the rays readily penetrated in order that the bones of the hand might be examined on the far side of the door. While this penetration is, in itself, not remarkable, when one stops to consider that the ray of this power is apparently harmless, the wonder of the feat can be more appreciated.

The most obvious advantage in the ability to use the tube at some distance from the subject is found in the wonderfully sharp and clear radiographs or X-ray pictures that may be taken in this manner. By increasing the distance be-



In the Oval: Stanley Operating the Switchboard of His Apparatus. At the Right: Drawing a Spark from One of the High Potential Terminals of the Transformer.

Above: Applying the High Frequency Treatment to a Patient. In the Oval: Looking Through a Patient's Body by Means of an X-Ray Tube and Fluoroscope Screen.

Above: Taking an X-Ray Photograph of a Patient. The Photographic Plate, Wrapped in Black Paper, is Placed Below the Part of the Body that is to be Photographed.

Photos. Janet M. Cummings.

tween plate and tube, the shadow cast upon the former is sharpened and distortion and enlargement are obviated. The ray also exhibits some interesting properties in connection with work on the tissues and organs. The production of a bone shadow and even bone detail is not difficult, but when the work embraces the differentiation of organs and blood vessels, the problems arise. From the specimen negatives Mr. Stanley showed the author, it may be assumed that his apparatus possesses some unusual advantages in this direction.

WORLD'S LARGEST TEA POT

According to the statement of the Japanese proprietor of a tea house at the exposition in San Francisco, the giant tea pot which he uses as a novel attraction is the largest in the world. It is over three and one-quarter feet in diameter, and stands three feet and a half high without its heavy wicker handle. Including the handle, the total height of this enormous tea pot is five and a half feet. It was made specially for this tea house in Shigaraki, a town 200 miles from Toyko in Japan, and cost, when delivered to the tea house, in the neighborhood of seventy-five dollars.

The Largest Tea Pot in the World.

A DARING PHOTOGRAPHER

For the purpose of taking a picture of the new giant of the seas, the battleship *New York,* a well-known marine photographer, E. Muller, Jr., risked his life in a little motor boat when he steered it directly in front of the battleship as it ploughed ahead full speed on its trial trip off the coast of Massachusetts.

In recounting his experience, Muller tells how he calculated his distance before the oncoming monster and at the crucial moment, when he sought to get the best possible picture, swung his little 16-foot open launch directly in the path of the ship, stopped for

a moment and sped out from under the very bow of the battleship. He took the picture as the big ship was making the last of her twenty-one trial runs and was under forced draft, going at a speed of twenty-three knots an hour.

The snapshot of the battleship was made "bow on" and is probably the best picture of its kind ever taken.

THRESHING FOREST SEED WITH A SIMPLE DEVICE

Every spring for the past few years the Forest Service has been setting out hundreds of thousands of young pine trees on the barren ranges of the western mountains. These young plants are first grown from seed in immense nurseries in which the seed is planted and grown just as in a private garden.

The hundreds of bushels of seed are bought from the farmers and settlers. The seeds are dried and then placed in a big, wire-meshed hopper and threshed out quickly. The threshing device, which is shown in the illustration below, is a simple device which is turned by hand. The seeds drop into a bin below, while the cones remain in the screened box.

It is estimated that at least ten million young trees have been set out in the West this year. While these are mostly pine, there are also large quantities of larch, spruce, fir and cedar, but all that are thus grown are of the cone-bearing family of trees.

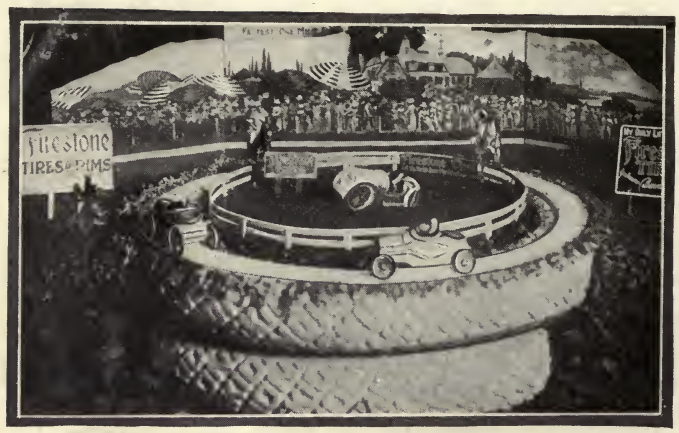
A Simple Screen Arrangement for Separating Seeds of Cone-Bearing Trees from Their Cones.

Thin Slabs of Concrete Placed Over the Brick Walls of this Church have Given it the Appearance of a New Building.

IMITATION STONE MADE FROM CONCRETE

Frame or brick houses can be faced with thin blocks of concrete so that a close imitation to stone results. The blocks are made in various sizes with a number of molds. A brick church which has been clad in a new dress to closely imitate colored sandstone is shown in the accompanying illustration. The change was made in about three weeks.

At last the question of how England can transport her troops across the Channel to France, in the face of the German submarine blockade, is explained. It is said that a netting extends across the Channel, thus preventing attacks on troop ships. The netting is made of heavy cables that are woven into meshes 18 inches square, thus making an effective barrier against submarines and torpedoes.



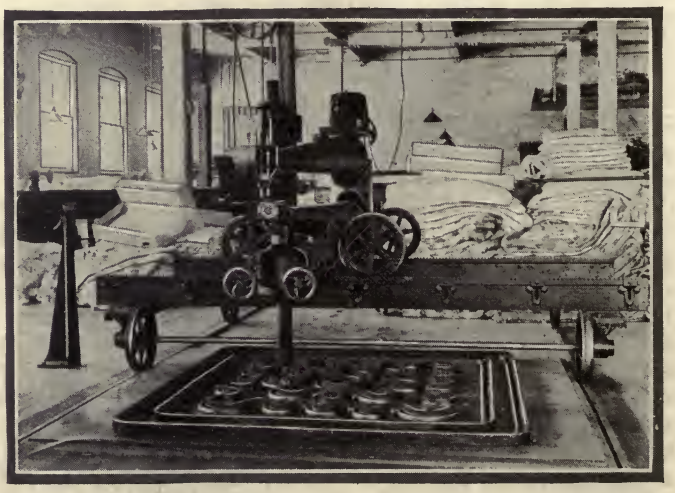
Miniature Automobiles Racing Around a Diminutive Track Form the Attractive Show Window Display of a Western Tire Dealer.

A RACE TRACK ON A MOTOR TIRE

With a large tire for the race track, a couple of miniature "speed devils" were sent around and around the show window of a Houston, Texas, tire dealer. The little machines were operated by an electric motor in the center of the race course, which was quite invisible, and the wires that connected with the little automobiles were concealed by the high artificial grass. The window attracted a great deal of attention, as a crowd is always held by a moving display. The window was arranged thus for the holiday season, and the car ahead bore the number of the old year while the pursuing machine bore that of the new year, the idea being that the New Year was chasing out the Old.

MACHINE SEWS COMFORTERS BY INTRICATE COGS

A machine which has some appearance of a huge drill press yet the delicacy of adjustment of a jeweler's lathe is employed by a New York manufacturer for sewing the various layers of cotton comforters together. The machine runs by electricity, and the design to be made on the comforter is controlled by a long steel arm which reaches to the floor. At its lower end is a cog which intermeshes with a "cog track" running in waves and loops over the floor and under the machines. As the comforter moves under the needle, the path of the needle is directed by the curious windings of the cog track on the floor. The cog track may be altered at will to suit the requirements.



By Means of an Intricate Cog Track on the Floor, this Sewing Machine is Guided in Sewing Comforter Layers Together.

PANAMA·PACIFIC·EXPOSITION·NOTES·

by

·H.A.EVELETH·

ONE of the largest electrical goods manufacturing corporations in the country has an elaborate display of its products in the Manufactures Palace. Among the constituent parts of this exhibit are several which prove of special interest to the layman. In one glass case are a score of incandescent lamps representing the gradual advance made in the development of this product. The first lamp is one originally produced by Mr. Edison in the year 1880. The filament is of carbonized bamboo and is fastened to its feed wires by means of two minute metal screws and clamps. The latter are soldered to the feed wires and their jaws clamp the filament terminals when the screws are set. Sufficient current is fed to the lamp to maintain the filament at a dull red color, for great care is taken not to burn it out. The last lamp of the series is one of the latest nitrogen-filled products. Near by the visitor will see the largest incandescent filament lamp yet produced. It has a candle-power of seven thousand, and, with the aid of a reflector, produces an intense white light of extraordinary brilliancy.

To illustrate the high tensile strength of a tungsten filament, an exhibit has been prepared wherein a 60-watt lamp is shown supported by the tungsten filament of a 100-watt lamp in such a manner that it is free to oscillate when acted upon by the air currents in the building. A thread of tungsten 0.005 inch in diameter will support a ten-pound weight, while the tensile strength of this metal is 600,000 pounds per square inch. It is so hard that it cannot be machined and must be fashioned by a process of grinding.

The chief feature of the exhibit is the Home Electrical, a ten-room house elaborately furnished, and fitted with every type of electrical apparatus which could be of possible use in such an establishment. The house is a marvel of simplicity and cleanliness and strikingly illustrates the usefulness and necessity of electrical energy as a medium for light, power and heat in the modern residence. This captivating Home Electrical is burglar-proof in that the doors and windows are fitted with burglar alarms, and a "master switch" is located near the head of the bed in the master's bedroom. By means of the latter the lights over the entire house may be thrown on; to the ineffectiveness of their associative switches and consternation

of the night prowler. The various rooms are interconnected by the inter-phone system, equipped with electric fans and illuminated by both the direct and indirect systems. A stationary vacuum cleaner located in the basement is piped to outlets set in the baseboards of the principal rooms, thus furnishing a more convenient method for housecleaning than would be derived from a portable machine. To give an idea of the completeness of the electrical installation, it will be necessary to mention the equipment of each room, while the figures in parentheses denote the cost of operating in cents, for one hour, the apparatus after which they are placed; calculations being based upon the rate of ten cents per kilo-watt hour.

LIVING ROOM

This room is warmed either by a quadruple glower radiator (20) or an air warmer (10). An electric reading lamp and cigar lighter (¾) are present on the library table, and an electric piano is playing over in the corner.

DINING ROOM

Upon the sideboard and dining table are a percolator urn (3½), a uni-set chafing dish (5), uni-set samovar (5), radiant grill (6) and toaster (5½). A telephone connecting with the kitchen is located near the head of the table. The room is warmed by a luminous radiator (10).

BEDROOM

Near the head of the bed is located the inter-phone and master switch. An electric heating pad (½) replaces the vexatious hot-water bag, and a glower radiator (7) warms the room. The shaving equipment consists of a one-quart water heater (4) and an indirectly illuminated shaving mirror. Other necessities are a hair drier (cool or warm air), a massage vibrator (½) and a curling-iron heater (¾).

NURSERY

Here we find a one-pint milk heater (3), a uni-set nursery outfit (5), a twin radiator and a heating pad.

BATHROOM

The room is warmed by a triple glower heater (7½) or cooled by a six-inch electric fan. A ventilating fan, placed in the outside wall of the room, serves to draw out the impure air. A pedestal type hair drier (½), one-half pint hot water cup (1½), and shaving mirror complete the list.

SEWING ROOM

The sewing machine is actuated by an electric motor (1) and the room warmed by a glower heater. The small-sized ironing board is equipped with a three-pound electric flat-iron (2¾).

KITCHEN

There should be no trouble about "keeping" the cook with such an equipment as this! The electric range (10 to 44) will boil the onions while the ozonator (1) will neutralize the odors emanating therefrom. If the air becomes too "close" the ventilator in the wall will draw it out-of-doors; if too warm the electric fan will adjust matters. The circulation hot water heater (30) supplies hot water for the baths in twenty seconds, or for the electric dish washer (2), if desirable. In contrast to the former is the electrically operated refrigerator and the ice cream freezer (2).

LAUNDRY

The laundry is complete with the washing machine (2), mangle (1¼), drier and flat-irons (3 to 5).

MILK ROOM

The equipment herein will appeal to those who keep one or more cows. It consists of a milking machine, cream separator (¾), bottle washer (1), churn (1¼) and cooler for creamery packages.

WORK ROOM

The handy man of the household will welcome the electric soldering iron, metal melting pot, grindstone, drill press, riveter, glue pot, chipping hammer and motor-driven lathe, which are to be found in this room.

THE GARAGE

The electric automobile is having its battery charged from the mercury arc rectifier, while the motor-generator in the corner is humming a tune to the accompaniment of the electric piano located in the living room; and rightly it should, for neither could live without the other. Receptacles are provided for connecting up the buffing motor and vacuum cleaner. The inter-phone on the wall completes the last detail of this remarkable Home Electrical.

He who hails from the country will be attracted by the live stock and poultry exhibits. There are pigs, horses and cows a-plenty, and they represent the leading types of American and foreign-bred stock. Among the several score magnificent horses is a blue-ribbon mare which tips the scales at 2,150 pounds.

The Carnation Stock Farm barns, wherein the cattle are kept, is equipped with the most modern apparatus for the care of the live stock and from a sanitary viewpoint is well nigh perfect. The men in charge are dressed in white, the cows are milked by vacuum machine and the milk is not exposed to the air until it reaches the dairy. Posted conspicuously is a notice, which reads, "No swearing allowed in Carnation Dairy Barns. These contented cows are not accustomed to profane language."

The Japanese long-tailed roosters are the most popular birds in the poultry exhibit. Akazasa, Haku and Shirafuji are their names, and they are proud possessors of tail feathers from eight to twelve feet in length. These dignified birds are taken out to exercise once a day and their tails are carefully enclosed in paper bags to keep them out of the dirt. Each rooster has a specially constructed home of his own. It can best be likened to the tall case of a hall clock with a small compartment fitted to its side at the upper end. The proprietor roosts in this compartment and lets his tail hang down in the space which would be occupied by the pendulum of the clock.

¶ A visit to the leading exhibits at the Panama-Pacific Exposition is afforded to the reader who follows this series. True, the visit is but a literal one, yet nevertheless a goodly portion of the vast fund of knowledge available to those visiting the Exposition Grounds is offered in these pages each month.

The dog fancier will be attracted to the remarkable collections of canines to be seen at the "Dogs of All Nations" concession. There are big dogs, little dogs, long dogs, short dogs; in fact, every type of a canine from a Japanese spaniel or a Mexican hairless to a Great Dane or an African bloodhound. Of unusual interest are two of the most distinguished dogs in the world, namely, the two surviving Esquimau dogs of the pack which accompanied Captain Peary to the North Pole. Ipsu, their leader, is now fifteen years of age.

Probably the most complete assortment of vehicles ever seen assembled under one roof is to be found in the Palace of Transportation. Here the visitor may view practically every type of conveyance used upon the land and water and in the air. The greatest space is devoted to the rolling stock used by the many railroad and railway companies of this country. The display includes various types of steam and electric equipment for both suburban and interstate service.

The paramount feature of this instructive exhibit is one of the oil-burning Mallet articulated compound locomotives. This engine is equipped with the Southern Pacific standard incandescent headlight. The source of light is from one of the latest types of nitrogen electric lamps of 140 c.p. and the beam projected is of sufficient intensity to enable the engineer to observe a man on the track at a distance of a quarter of a mile; or twice the distance required to stop a train running at a rate of forty miles per hour, by the emergency air brakes.

The official classification of the rolling stock employs letters and figures to indicate principal dimensions and is of interest by reason of its being printed upon some conspicuous portion of the vehicle. Thus, upon the cab of the Mallet locomotive appears the classification

$$\text{MC-57}\ \frac{\text{26-40}}{\text{30}}\ \text{401-S,}$$

in which "MC" denotes that the locomotive is of the Mallet Consolidation type; "57," the diameter of the driving wheels in inches; "26-40," diameter of high and low-pressure cylinders in inches; "30," stroke of piston in inches; "401," weight in pounds on driving wheels in nearest

even thousands; and "S," that locomotive is equipped with a superheater.

The maximum tractive power of this engine is 94,880 pounds, while its hauling capacity at 10 miles per hour on a level tangent track is 16,940 tons. In marked contrast to this great machine is the first locomotive to traverse a transcontinental railroad. It was built for the Central Pacific R. R. in the year 1863 and has a hauling capacity of 660 tons under the conditions specified for the Mallet locomotive. Additional data relative to the latter is presented in the following table:

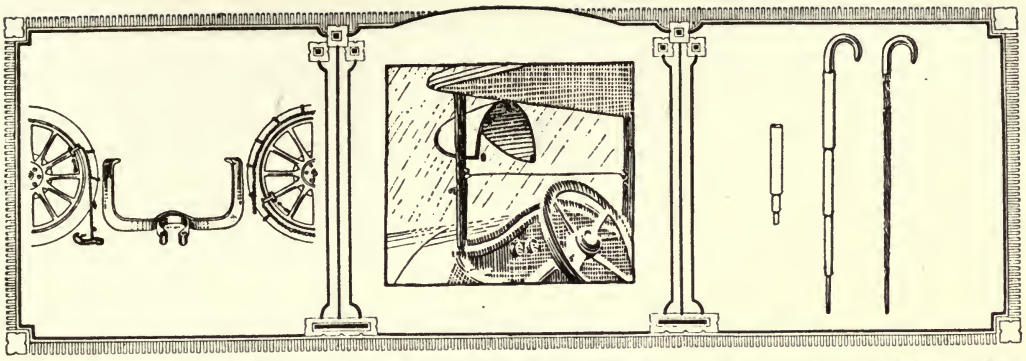
Total weight of engine	435,800 lbs.
Loaded weight of tender	189,200 lbs.
Capacity of tender, water	9,816 gal.
Capacity of tender, fuel oil	3,610 gal.
Total wheelbase of engine	57 ft. 7 ins.
Total wheelbase of engine and tender	90 ft. 4 ins.
Diameter of driving wheels, outside	57 ins.
Diameter of tender wheels	33 ins.
Type of boiler	Straight
Working pressure per square inch	200 lbs.
Outside diameter of boiler, first course	84 ins.
Length of fire box, inside	126 ins.
Width of fire box, inside	78.25 ins.
Heating surface of superheater	839.0 sq. ft.
Total equivalent heating surface	6876.0 sq. ft.
Grate area	68.4 sq. ft.

The varied assortment of waterfalls and artesian wells in the Palace of Machinery demonstrates the efficiency of the many types of pumping and irrigation apparatus on display. Chief among these is an irrigation plant consisting of an 80 h.p. Bessemer oil engine connected by rope drive to a centrifugal pump having a capacity of 5,000 gallons of water per minute. The water is forced through a 12-inch diameter wood-stave pipe to a height of about thirty feet, from which it falls in a huge cataract to a tank below.

The largest color press ever built may be seen in operation at the Palace of Machinery. It is known as the Pancoast Universal Unit Press, and prints a portion of the Sunday edition of the "San Francisco Examiner." This gigantic machine is 48 feet long, 9 feet wide and over 12 feet high. It has a net weight of 130 tons and an 80 h.p. electric motor is required to operate the mechanism. Every precaution against accident has been taken by the application of "Safety First" devices. The gears are protected by iron guards, an electric gong rings automatically just previous to the starting of the machine; contrivances are present which make it impossible for a pressman to have his hands caught between the cylinders, and the entire operation of the press is controlled by several electric push-buttons. The construction is more rigid than heretofore attempted, and it is claimed that the vibration has been so minimized that a nickel can be balanced on the edge of the top frame when the press is running at full speed. The hourly capacity of this press is 40,000 copies of a 48-page paper, but the production varies with the number of colors being employed and the number of pages being printed. The rolls of paper are 73 inches wide and weigh 1,200 pounds each. Six rolls are loaded on the machine at one time. The Sunday edition of 250,000 copies of 80 pages each, requires more than 3,400 miles of paper of a width of one page.

STEAMERS TO CARRY AEROPLANES TO ARCTIC REGIONS

An aeroplane on each steamer which plys to the Arctic regions will be the latest use of this invention. The northern route is frequently blocked by icebergs and ice floes. Steamers lose much time in searching for a channel and then usually do not find the best one. The plan adopted by a Norwegian steamship company and which will soon be put in operation is to have an aeroplane on each of their steamers, so that when ice is sighted the aviator will ascend and fly over the ice until he determines the best channel. Then he will inform the captain by a signal system which route to follow. This novel use of the aeroplane will greatly reduce the time rate from the Norwegian ports to the Russian destinations on the Arctic Ocean.



Tool for Tire Chains. A Novelty in Wind Shields. A Combined Umbrella and Cane.

Recent and Improved Devices

Helps Attach Tire Chains

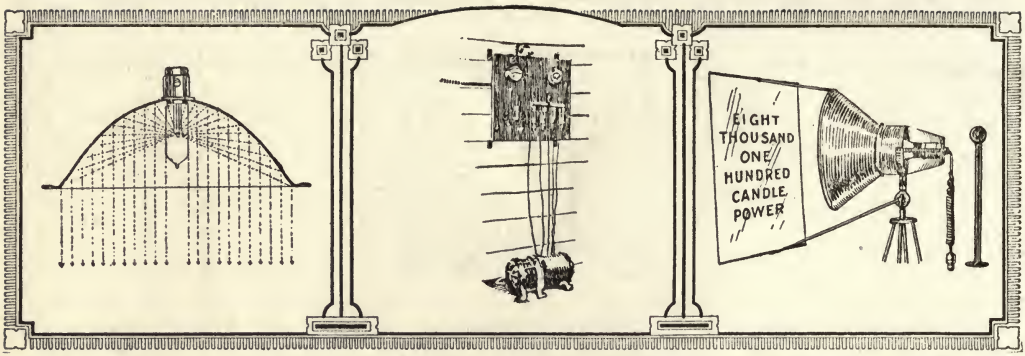
Instead of undergoing the unpleasant task of attaching tire chains to the rear wheels of an automobile by the usual process of placing the chain on the ground, running the automobile over it until it is properly in place—a task which is accompanied by soiling the hands and clothing—an attachment has been placed on the market to prevent all these unpleasant things, and it can be put in place with very little effort. It consists of a stout metal U-shaped clamp which fits about the rim and holds the chain firmly in place. The attacher is snapped in place in an instant. One end of the chain is hooked about a curved projection, the car is run ahead one revolution of the wheel, the other end of the chain is hooked, and the usual troublesome task is over with. A jack is unnecessary.

Something New in Wind Shields

Wind shields ordinarily have one grave disadvantage; that is that they instantly become clouded in snow or rain storm. A new type of shield has been brought out which entirely banishes this evil, by giving an unobstructed line of vision to the driver, whether it rains, snows, hails or what not. The new wind shield is nothing more nor less than a transparent, cap-like attachment which fits on the glass at the spot where the driver's line of vision passes. The cap projects out over this spot to a sufficient distance so that no matter how heavy the rain or snow storm is, the cap and the air currents which it creates prevent any vestige of moisture from collecting on the glass in front of the driver. The rain shield is constructed of a flexible, transparent sheet of "pyralin," which can easily be adjusted to any desired shape, like a visor or bonnet. It is held securely in place by five vacuum cups. These cups hold the shield in place so rigidly that wind, no matter how forceful, will not tear them loose; yet they can be removed if desired by sliding the thumb nail under the rim.

Umbrella and Cane Combined

A western manufacturer has hit upon the ingenious idea of combining for wet and sunny weather, respectively an umbrella and a cane. Now that walking sticks have again come in vogue, the man who for personal reasons objects to carrying an umbrella on cloudy days on the uncertain possibility that rain may set in and he will be caught in it, can carry a cane which to all appearance is nothing but a cane, but which in reality is nothing but the ornamental outer structure of an umbrella. The cane is constructed of a varnished stick of hollow bamboo sections which fit over the silk umbrella covering, and when not in



A Parallel Ray Reflector. Battery Charging Equipment. New and Powerful Lamp.

use can be collapsed and readily carried in the pocket.

Lamp Reflector Throws Parallel Rays

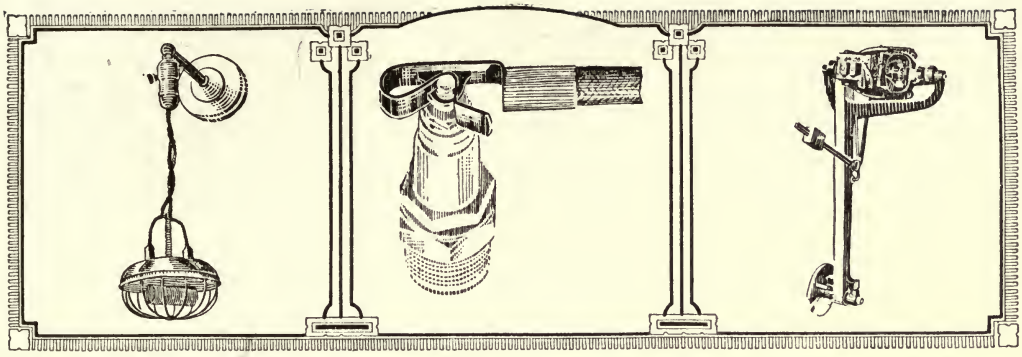
One of the latest conveniences for automobile and motor boat owners is an electric lamp and reflector which throws a powerful concentrated beam of light straight ahead. The lamp is claimed to be more efficient and brighter than even the nitrogen-filled lamp which has already made noticeable inroads into the ordinary tungsten lamp trade. The new lamp is filled with a peculiar new gas of unusual properties, and it is manufactured in sizes small enough to pass through the rear of any reflector without fingering the reflector as is ordinarily necessary. A slender tubular bulb is employed instead of the usual round lamp, with the result that greater efficiency is gained. In using a round bulb the rays of light must pass through the glass globe twice after leaving the reflector surface, whereas in the case of the tubular lamp all rays of light are projected ahead with no resistance after they strike the reflector. A small, intensely bright "spot" of light characterizes the new bulb, with the result that the rays are of a clearer quality than is obtained with the long, diffusing filaments.

Battery Charging Equipment

A battery charging equipment to meet the constantly increasing demands of the automobile trade has recently been put on the market. This equipment consists of an exceedingly compact motor-generator and a simplified switchboard, so that an inexperienced operator cannot cause a great deal of harm. One of the most ingenious details of the equipment is its provision for starting. The motor is non-self-starting, being started from the direct current end, the current being supplied by the batteries which are to be charged, the generator acting temporarily as a motor. This method of starting is accomplished by an arrangement of the knife switches on the switchboard. When the switch is thrown partly in, battery current flows into the generator; it acts as a motor, and when sufficient speed has been attained the switch is pushed in the remainder of the distance, and the line current takes up the work. No other change is necessary, as the batteries are already in circuit.

Photographic Light

The nitrogen filled lamp makes it possible for the photographer to make quick, fully timed exposures by artificial light and this without the use of the objectionable explosive flashlight. Among the several reflectors and diffusers recently placed upon the market to meet the demand for a suitable fixture in which the nitrogen filled lamp might be used for photographic purposes is the one shown on this page. This device, it is claimed, will furnish a splendid light for the studio, for home portraiture, and for printing and enlarging. Ample provision is made for the dispersal of the heat generated and the reflector is so arranged that a perfect diffusion of the light is effected.



Novel Electric Heater. Connector for Spark Plug. Motor-Driven Swing Saw.

A New Idea in Electric Heaters

An electric heater which has features decidedly original is illustrated in one of the drawings on this page. One of the smaller editions of the heater is manufactured in the form of an inverted incandescent lamp, and it is particularly adapted to the heating of small rooms, such as nurseries, bathrooms and offices. It can be suspended from the electrolier or socket and quickly removes the chill and dampness of early mornings and evenings. Another heater of the same type is made to resemble an open wood fireplace. Coils are inserted inconspicuously between two of the front logs, and the appearance of the glowing coils when they are in use closely resembles that of logs that are really burning. The log is made of a composition of lasting material. These heaters are constructed on a new principle. Each unit attains a temperature of 2,000 degrees Fahrenheit. In other forms, the maximum temperature reached is never greater than 600 degrees. About one or two minutes are required to attain 2,000 degrees, at which point the temperature remains constant.

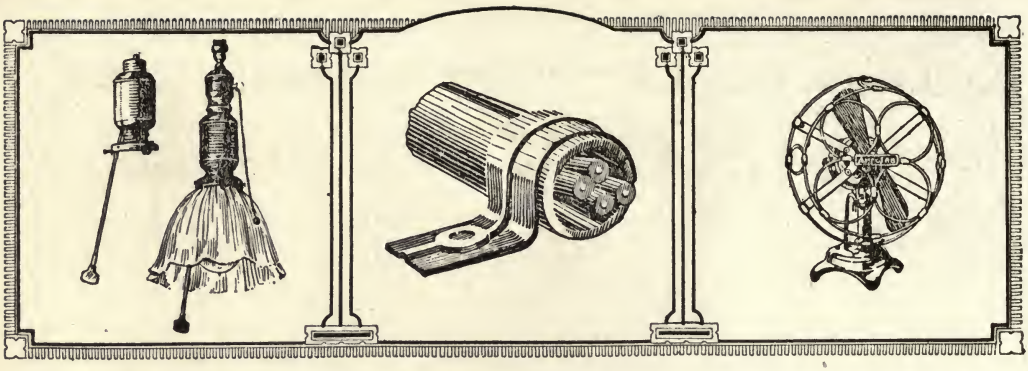
Novel Spark Plug Connector

A spark plug which can be attached in remarkably short order has been put on the market by a well-known manufacturer of electrical apparatus. Motorists will appreciate the saving in time which is effected by the new clip for testing for burned out porcelains and the other faults common to spark plugs. The clip is fastened to the end of the high-tension cable and can be attached to the spark plug by slipping the threaded stud of the plug through the hole of the connector, releasing the spring, and the stud will be gripped tightly by the strong spring pressure. This connector has the added advantage that it can be shaken off only with great difficulty.

Compact Electric Saw

A saw for packing rooms which is remarkably light and compact has recently been designed by an electrical manufacturer. It is intended for use in factory shipping rooms for the preparation of crating lumber. A number of original features are claimed. In the first place, the motor and saw are combined into a single unit. They are joined by an arrangement of cogs which are contained within the walls of a rigid steel case. A second feature is that no line shafting of any sort is required. The complete equipment can be installed wherever it is desired in a few seconds, merely by attaching it to a solid support of some kind with four bolts or lugs. The motor is self-regulating, current being supplied to it through two wires. Aside from the advantage gained in its movability, a considerable saving is effected in the fact that no line shafting with its constant loss is necessary. This means that when the saw stops work, the consumption of current likewise stops.

If you enjoy THE WORLD'S ADVANCE, tell others; if not, tell us.



A Turn-Down Lamp Socket. Simple Conduit Clamp. Fan with Aeroplane Propeller.

Lamp Socket Saves Electricity

There are a number of devices on the market for the purpose of dimming the glow of an electric incandescent lamp, but they are either uneconomical of energy consumption or else their construction is delicate and they require a high maintenance cost. If economy in power consumption is to result from the use of devices of this kind, they must be exceedingly efficient, because the energy consumed by the lamp, even at normal voltage, is very small. A new device, called the "Turn-lo," averts these disadvantages in economizing energy by the use of an inductance coil, which may be connected in series wholly or in part with the lamp or a similar load. During full illumination, that is, normal operation, the inductance is short-circuited upon itself, and thus not subject to energy losses, while for conditions of reduced illumination, a part or whole of the inductance is connected in series with the lamp filament.

A Novel Clamp

One of the greatest time consumers in the field of electrical contracting is the ordinary conduit clamp, which requires much costly effort on the part of high-priced electricians to install. This disadvantage is eliminated to a large degree in a new conduit and cable-hanging clamp, or clip, which has recently been put on the market. Only one bolt, lug or screw is required to install it, yet it supports the heaviest of conduits and cables readily.

Fan Built Like an Aeroplane

An electric fan which resembles in many ways an aeroplane and upon whose behavior some interesting statistics have been tabulated is now manufactured. The "Aerofan," as it is called, embodies only two blades, instead of the conventional four, yet it ejects an astonishing amount of air. Two thousand nine hundred and ten feet of air a minute at 28.4 miles per hour is the output of the Aerofan. This air current can be felt noticeably at a distance of more than thirty feet. The various requirements which are demanded of any electric fan are met, in spite of the fact that the Aerofan weighs less than five pounds. Probably the most interesting claim of the manufacturers is that the new fan will actually blow air back through the blades of any fan of its size on the market. However, for sick room use and in places where a strong breeze is not desired, the usual adjustment arrangement is provided, so that a very gentle breeze can be obtained. The Aerofan, because of its small size, has required an infinite amount of resourcefulness in the construction of its tiny motor. The shaft and armature are perfectly balanced—just as in large, costly machines; the bearings are of babbit metal and a gravity wick oil feed is provided.

By placing a small, two-candlepower electric lamp on the front porch and back porch of a country home, a fair protection against burglars is secured. The cost of operating two such lamps throughout the night is not over one cent —cheap burglar insurance indeed.

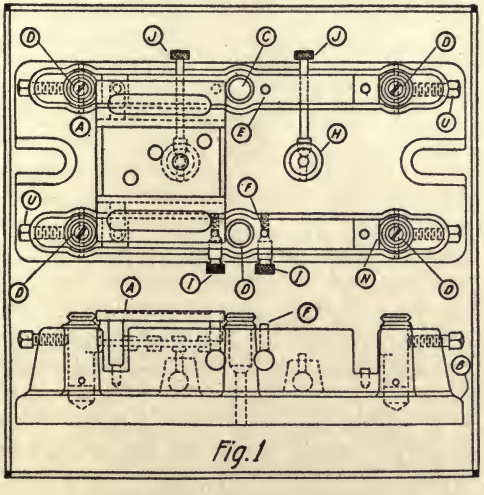
A PROFILING FIXTURE

By E. P. Fickes

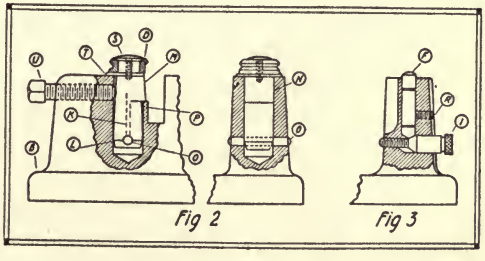
In the construction of small machines, such as cash registers, sewing machines, etc., there are parts that must be machined with the least amount of variation possible, and the manner in which these parts are held is worthy of much consideration. Difficulties arise when the part has no projection or lugs, making it impossible to use clamps. The fixture described is designed to hold two castings while profiling the top and the bosses on the inside. One of these castings is shown clamped in position on the fixture at *A*.

The base, *B*, Fig. 1, consists of a casting finished on the top and bottom. Holes should be drilled and reamed for the stationary jaws, *C*, *C*, and for the movable jaws, *D*, *D*, *D*, *D*, as well as for locating pins, *E*, *E*, *E*, and adjustable supports, *F*, *F* and *H*, *H*.

Two holes should be drilled, counter-



bored and tapped in the sides for the adjusting screws, *I*, *I*, and *J*, *J*. The jaws, *C*, should be turned from a piece of tool steel to the desired shape, then hardened and ground where necessary and driven



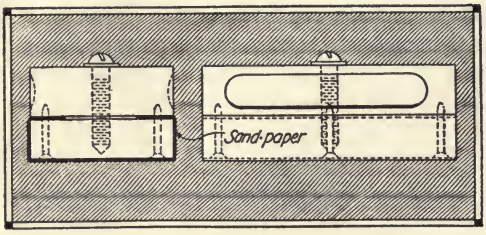
into the base, *B*. The movable jaws, *D*, shown in Fig. 2, should be made in two parts. The body, *K*, consists of a tool steel forging finished to fit the hole at *L*, then milled flat on each side at *M* to fit into slot, *N*, in the base, *B*. A hole is drilled and reamed in the end for pin, *O*, after which it is cleared away, as shown at *P*, to allow the body, *K*, to move back and forth. The jaw, *D*, is made of tool steel, hardened, ground, and lapped to fit shoulder on body, *K*, and is held in place by screw, *S*, which also serves to hold in position dust washer, *T*, thus preventing chips or dirt from interfering with its movement.

In Fig. 3 is shown the adjustable support, which is operated by means of the cone-shaped screw, *I*, against the inclined surface of pin, *F*. This support is also used at *H*, taking care of the thrust of cutter while profiling the bosses or lugs on the casting, *A*. This method of clamping affords little chance of springing or

distorting the parts to be milled, and holds them rigidly, requiring but little pressure on the screw, *U*. The jaws, *C* and *D*, can be used their entire circumference before being replaced, making the upkeep comparatively small.

Handy Sandpaper Holder

A handy sandpaper holder can be made from two blocks of wood, one of which is ½″ thick and the other ¾″



thick, both being of the same length. The width is optional. With a marking gauge, lines should be scribed ⅜″ in from the edge of the ½″ block. Drill a 3/16″ hole through the exact centre of the ¾″ block and fasten the two blocks together with a round-head brass screw. Where the scribed lines cross on the surface of the thin block, drive No. 16 steel brads, ⅝″ long, through into the thick block, and another brad in the centre of each of the long sides, or six brads altogether. These brads are for the purpose of holding the sandpaper in place. With a gauge cut grooves along each of the edges of the thick block for finger holds. The sandpaper should be clamped in place as shown.

Contributed by

A. P. H. Paul.

Substitute for Filter Paper

In case of a lack of filter paper for use in experiments in chemistry, a very good substitute is found in sanitary paper towels which are now in such common use. Cut the paper into circles the desired size, and it will be found to do the work practically as well as the regular filter.

Contributed by S. H. Samuels.

A Rubber Name Stamp

A rubber name stamp can be made quite easily if the following directions are observed. The name should be written on a waxed zinc plate, care being taken that the wax is cut completely through. Hydrochloric acid should be painted over the wax and allowed to eat its way half through the plate which should be ⅛ inch thick. Hot water should be poured on the plate to remove the wax. The rubber should be pressed into the etched lines and vulcanized.

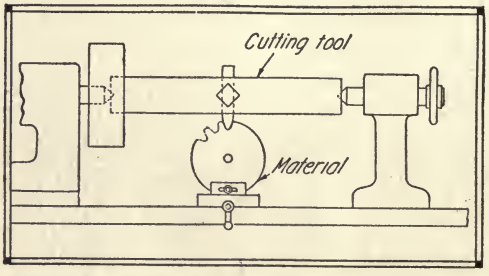
This suggestion is given as an improvement upon the method described by Mr. E. F. Hallock in a previous issue.

Contributed by

W. Christnagel.

Cutting Small Gears in a Lathe

A gear-cutting tool for the amateur mechanic is shown in the accompanying illustration. The body of the tool con-



sists of a 1½″ steel rod about 15″ in length. This rod should be centered at both ends in the lathe. At the centre of the rod, two small holes should be drilled. One of these should be filed out square to accommodate the cutting tool and the other threaded for a lock bolt. The material for the cog is a disc of metal of the desired diameter. It should be clamped in a slide rest and turned as the succeeding teeth are cut.

Contributed by F. P. Dickover.

Acid Cuts Hole in Glass

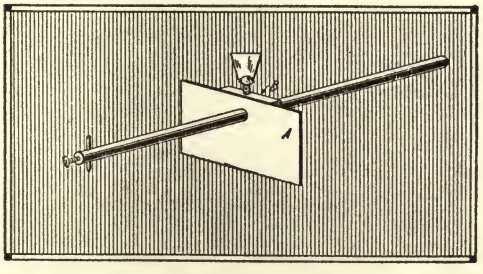
Hydrofluoric acid will cut a hole through glass in short order. A dam of wax should be placed about the spot where the hole is to be made, and into it a few drops of the acid should be poured. Hydrofluoric acid will dissolve nearly all substances, and it should be handled carefully. It is sold in small wax bottles.

Contributed by
THEODORE GOTHMANN.

A Makeshift Marking Gauge

A marking gauge that will answer for most purposes about the experimenter's workshop can be constructed along the following lines:

A long, true rod of brass or iron should

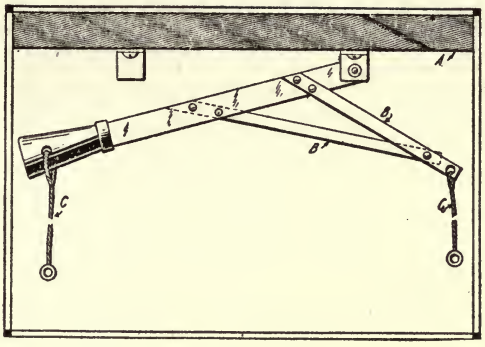


be bored at one end with two holes, one for a marking point and the other for a set screw to hold the marking point, or scribe, in place. Referring to the drawing, *B* is a block of hard wood bored with a hole which should be threaded to accommodate a wing clamp screw. *A* is a larger wood board of thinner material along which the object to be marked slides.

Contributed by
JAMES J. ROGERS.

Knife Switch Controlled by Cords

A knife switch located on the ceiling can be controlled by two cords, if two stiff metal strips are brought out to a point, one from the hinged end of the blade and the other from its centre and riveted as shown. One cord should be fastened to the end of the two strips and the other knotted through a hole



bored in the handle. Pulling on cord *G* closes the circuit; pulling on cord *C* opens it. The metal strips are indicated as *BB* in the drawing.

Contributed by
EARL B. WILLIAMS.

Freeing Sash Weights

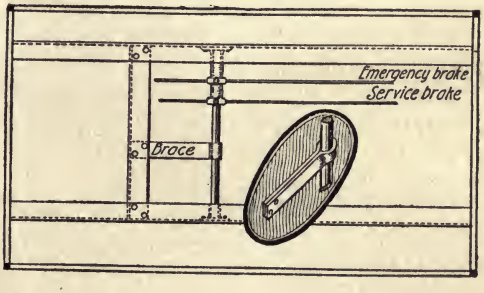
Sash weights which have become jammed can usually be freed by removing the pulley and prodding. A length of stiff wire or an ordinary kitchen poker will do.

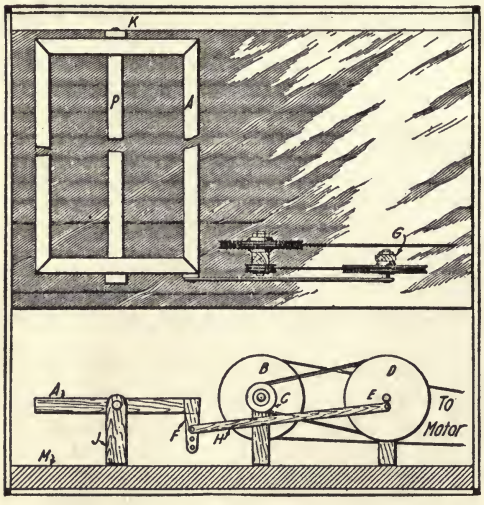
Contributed by
WM. C. HOUGHTON.

To Reinforce a Strained Brake Shaft

An automobile brake shaft which has become bent through repeated strains and jolts can be stoutly braced with little trouble, so that further bending is avoided and the possibility of the shaft breaking is eliminated. A strip of heavy steel should be bent at the middle to fit snug about the shaft and its two ends brought back and riveted to the cross beam.

Contributed by ADOLPH KLEIN.





Developing Plates by Motor Power

When a large number of plates are to be developed the following machine will save considerable labor:

The entire frame is made of ¾" by ¾" white pine.

The wheels, *B*, *C* and *D* should be built according to the speed of the motor since the wheel *D* must run very slow, namely 30 r.p.m. The wheels, *B* and *C*, are mounted on a shaft threaded at both ends, with a burr on both sides. A round-headed screw is passed through the wheel, *D*, into the support, *G*.

The rack, *A*, may be made as large as desired to fit any number of trays. The supports, *J* and *K*, are slotted at the top, so that one rack can be easily taken out and another put in its place.

The stroke at *E* should be very short and allowance made for adjustment at *F*; otherwise the rack will be tipped too far and the developer will be spilled.

The pitman, *H*, is made of ½" x ¼" white pine, and slotted at connection with *F*, so that it can be lifted off when taking out the rack.

The brace, *P*, connects the feet, *M* and *N*. If the machine is to be used for large plates or many trays, two pieces should be put in, one at each end of *N*.

With any small battery motor and two or three dry cells this machine will operate successfully.

Contributed by M. A. Piper.

Improved Non-acid Soldering Paste

Zinc chloride, one of the constituents of a non-acid soldering paste described in the January issue of this magazine, is not kept in stock by the average druggist on account of the fact that this chemical is very deliquescent, that is, it absorbs moisture very rapidly. Ammonium chloride, which does not possess this undesirable quality, can be substituted with equal results in the formula.

Ammonium chloride flux can be put up very conveniently in old library paste or tooth paste tubes which have previously been thoroughly cleaned.

Contributed by

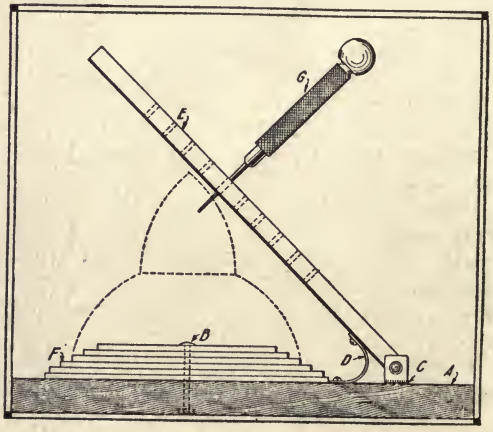
Reid L. Kenyon.

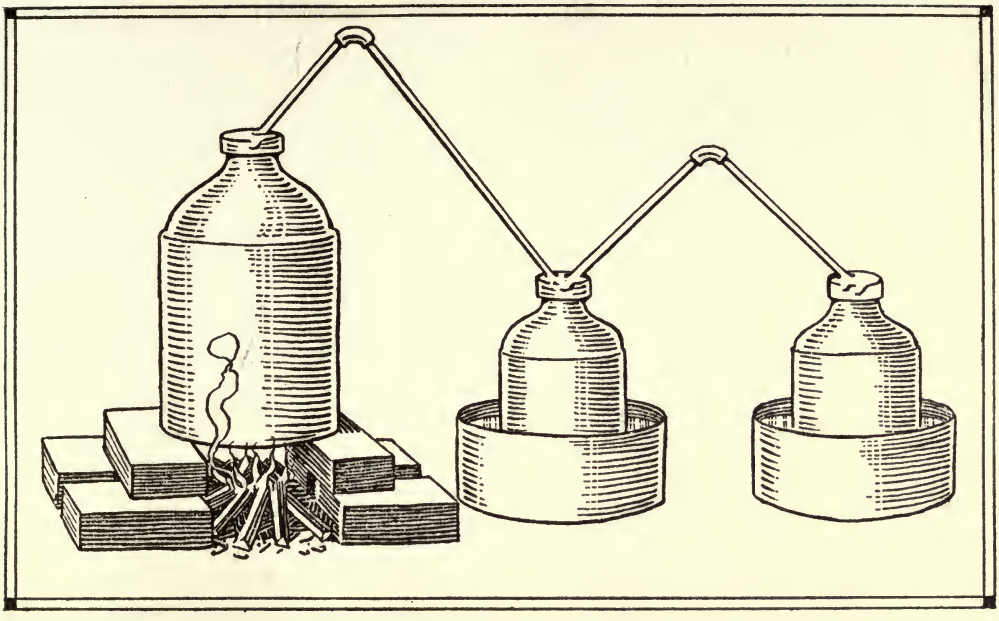
Marker for Spun Brass Caps

Marking lines about spun brass caps of various shapes can be done easily and quickly with a tool of the following construction:

Referring to the accompanying drawing, *A* is the work bench top, and *B* is a long bolt with which fibre discs, *F*, in graduated sizes are bolted to the bench. The marker consists of a spacing bar, *E*, bored with spaced holes to fit the point of the marker, *G*. The space bar is hinged to the bench top at *C*, while a spring, *D*, serves to maintain a constant pressure. The cap is marked by revolving it upon the fibre base, the marking tool meanwhile scribing a line.

Contributed by Earl B. Williams.





A MERCURY STILL USED BY ALASKAN MINERS

By Geo. F. Worts

Several times during the gold strikes in Alaska the cost of mercury, which was used for amalgamating gold from loose sand, rose in price to a point far exceeding that of pure gold itself. This was particularly true when "color" was discovered in the fine sands along the banks of the lower Yukon, several years ago. A miner with a pan and a bottle of mercury could recover as much as $50 worth of gold in a day in some of the richer localities, if he worked diligently. When the gold amalgam became saturated with the precious metal it was necessary for the miner to suspend mining operations and distill the mercury from the gold, thereby recovering in their more or less pure states both the mercury and the gold.

Some of these mercury stills were quite ingenious, although naturally very crude, and their construction, or, at least, their theory of operation will probably contain a helpful suggestion to the amateur chemist.

The thick, yellow alloy of mercury and gold was placed in a small yet deep earthen jug (metal vessels are not suitable for handling mercury) and from the mouth of the jug a wooden tube was projected. This tube was sealed into the mouth of the jug with clay. About a foot from the mouth of the jug the tube was joined to another of the same size at a sharp angle by means of wire and clay. This second tube led down into another earthenware jug, which was set in a pan of cold water. The purpose of the sharp angle at the juncture of the two points was to prevent any mercury which condensed in the tube from remaining there. Then, too, wooden tubes are difficult to bend.

From the second jug, which was the primary condenser, a third tube ran and was jointed at a sharp angle identical with the other. The fourth tube was led into a second condensing chamber, set, as in the case of the preceding one, in a pan of cold water.

To operate the mercury-gold still, the amalgam was placed in the first jug and the jug placed upon small stones between which a fire was built. When the tem-

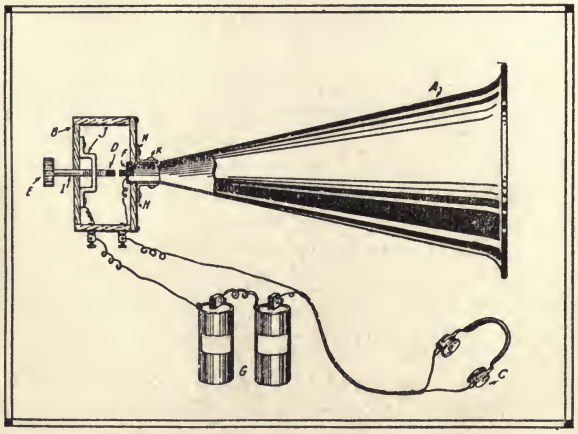
perature was raised to a point sufficient to distill the mercury, mercury vapor was formed, which passed through the tubes and condensed in the other two jugs. Pure gold remained, and the mercury could be used repeatedly.

The writer has witnessed the selling of a mercury still of this type, by a miner who had taken out all the gold he could carry, to a newly arrived prospector for the sum of $175. It would cost probably no more than fifty cents to construct.

To Study the Acoustics of the Air

In the accompanying drawing is shown an instrument which will give excellent results in studying the acoustic properties of a room.

It consists of a horn, *A*, which may be an ordinary phonograph horn, for collecting the air vibration. At the small end of the horn a microphone, *F* and *D*, should be attached. One side of the microphone should be made of a mica diaphragm to the center of which a small carbon projection is fastened, and both fastened to the end of the horn. The other contact of the microphone should be supported by a brass frame, *J*. The carbon should be fastened to the end of the threaded rod, *I*, which should be made adjustable by the knob, *E*. The frame is to be constructed of ¼-inch brass rod. A wood box, *B*, should be built about the microphone, and attached to the horn by brass strips, *H*, *H*, and by brass screws, *K*, *K*. The remainder of the equipment consists of a set of two dry cells, *G*, and a pair of sensitive double-telephone receivers.



Sound waves will be collected by the horn and registered in the receivers, after the microphone has been adjusted properly. Records of sound waves as affected by temperature and air pressure may be kept.

Contributed by
FRANCIS B. DEARDORF.

Carrying Case for Small Drills and Taps

A handy carrying case for small taps and drills can be made from a short length of brass tubing. The tube should be sawed into two lengths, one of which is to serve as a cap for the case. One end of each tube should be closed with a brass disc which is first soldered in place and then filed to the size of the tube. A strip of brass an inch wide should be rolled, fitted into the neck of the longer tube so that half of it protrudes, and soldered. The shorter end—the cap—fits on over this.

Contributed by
EARL B. WILLIAMS.

Odd Use for Old Files

The old custom in machine shops of tacking a strip of sandpaper under each gas jet for the purpose of striking matches can be improved upon consider-

ably by using short lengths of worn out files. The files should be annealed and cut into short lengths, and a hole drilled in one end for a nail.

Contributed by

CHARLES H. ANDERSON.

Instead of Tapped Holes

Difficulty is usually experienced in tapping holes in thin metal. A simple method which will accomplish the same results is to bore a hole somewhat larger than the shank of the screw and solder a nut, tapped for the same thread as the screw, on one side of the opening.

Contributed by

WALTER FRANSEEN.

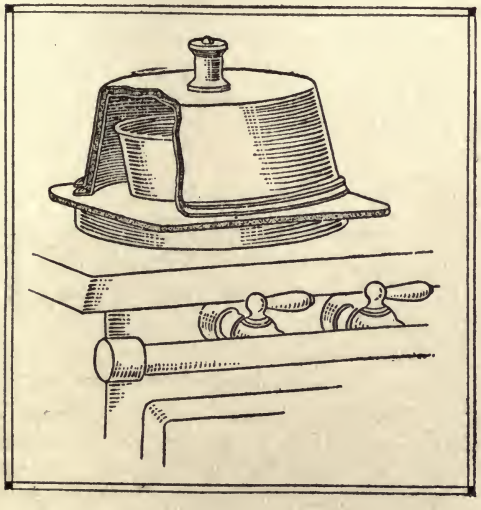
Useful Device for the Stove

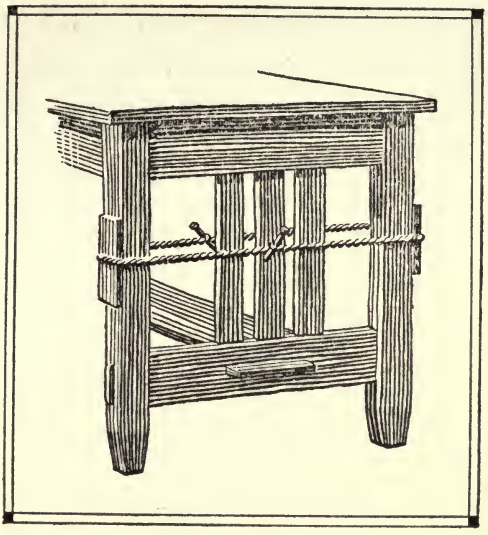
This is a heat-retaining cover for flat irons having detachable handles. Incidentally it can be used as a potato-baking oven. The construction follows:

Separate two deep pie pans about ten inches in diameter with several layers of sheet asbestos. Clamp them together with a bolt passing through a hole in the centre of the bottoms and terminating in a wood spool.

In use, the pans should be placed upon a square board of asbestos, which in turn is placed upon a ring of iron.

Contributed by C. H. PATTERSON.





Improvised Wood Clamp

In constructing the table which was described in the April issue of THE WORLD'S ADVANCE, the writer experienced considerable difficulty in clamping the ends together. However, he finally hit upon the plan which is illustrated in the accompanying drawing, and it accomplished the desired results very satisfactorily.

Contributed by

E. A. HODGSON.

A Chart for Computations

In all computations involving a common factor—and this applies to a great many workshop and laboratory problems—the short cut described below will be found useful. A large sheet of paper should be ruled with fifty lines in one direction and sixteen in the other. In the first column the consecutive numbers from 2 to 50 should be written. A decision should then be made as to what factors are the most commonly used. One commonly used factor is 3.1416, which is used in determining the different values of circles. One of the remaining columns should be headed with this number, and the various products of 3.1416 found by multiplication and inscribed in the various columns from 2 to 50 (or from 2 to 99, if provision has

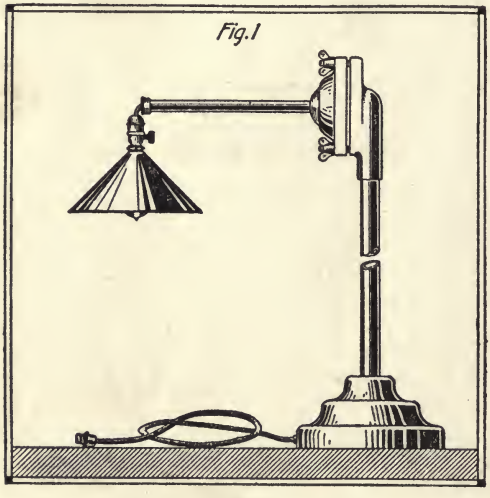
been made for that many numbers). The other columns should be headed by other commonly used factors, which should be multiplied by consecutive numbers and placed on the sheet in their order.

Contributed by

H. JOHN GRAY.

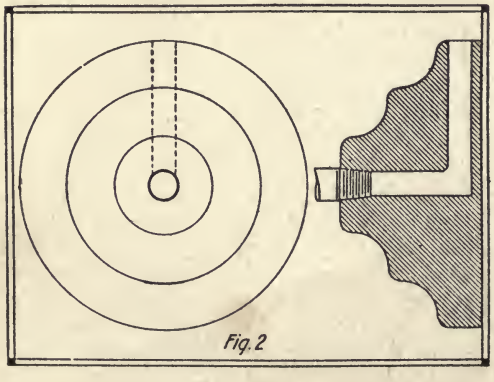
A Home-Made Table Lamp

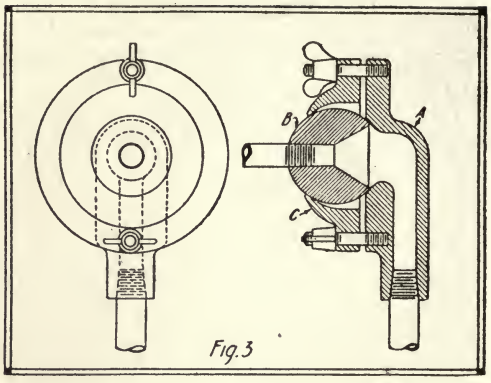
A little experience in forging and lathe work is necessary in order to construct the student's table lamp illustrated in the drawings which accompany this article.



The completed lamp is shown in Fig. 1; the casting for the base, in Fig. 2, and the adjustable socket for regulating the light, in Fig. 3.

The base may be cast of brass, iron or aluminum in the desired proportions. A pipe of any desired length connects the base to the adjusting clamp and socket. This pipe should, of course, be hollow to admit the passage of lamp cord. Referring to Fig. 3, the tube from the base is screwed into a small culvert running through a round casting and terminating in a flaring opening. The socket, rounded as shown, fits into this opening. A smaller tube connects the socket to the lamp socket.





Regulation of the lamp stand is had by loosening and retightening winged nuts which clamp a metal covering tightly over the socket.

Contributed by

G. W. JAGER.

An Emergency Ruby Lamp

A makeshift ruby lamp for photography can be made by wrapping several thicknesses of Japanese ruby tissue paper about an electric light bulb and held securely in place by several rubber bands. Several thicknesses of paper should be used to guard against pin-holes.

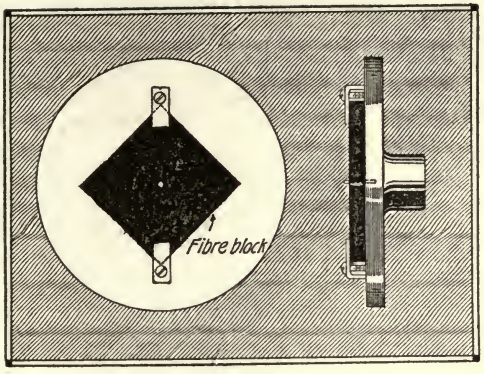
Contributed by

H. W. PRATT.

Dustless Window Cleaner

A dustless window cleaner can be made by filling a linen bag with powdered chalk. When the cleaner is used, the bag should be dipped in a bowl of denatured alcohol. When the bag is rubbed over glass a milky surface results. This should be removed by brisk rubbing with a clean cloth.

Contributed by L. E. FETTER.



To Cut Large Holes in Fibre

Large holes can be cut in small-sized fibre pieces by clamping the fibre in a lathe chuck by means of a special holder, as shown. The cutter should be small and thin.

Contributed by

JOHN TIMMER.

To Remove Surplus Glue

Surplus glue should not be wiped off while fresh, nor should it be left to dry. In the first case, it lowers the appearance of the work and often prevents stains or varnishes finishing properly. If it is left until dried, it is difficult to remove, and the work may be marred in the effort. The best plan is this: Allow the glue to remain where it is for an hour or two until it becomes jellied; then scrape it off cleanly with a thin knife or chisel.

Contributed by

WM C. HOUGHTON.

Triangle Protractor

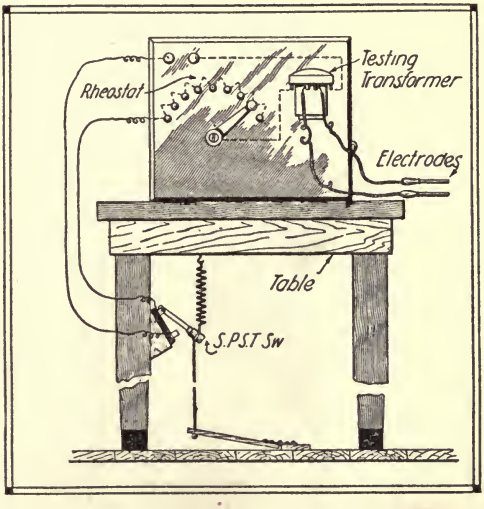
The combination of a triangle and protractor will prove to be a very useful addition to the implements of the draftsman. The degrees may easily be marked on the surface of an ordinary celluloid triangle, as this material is readily scratched with a sharp point. On the perpendicular of the triangle, a scale may be marked, thus further enhancing the value of the instrument. The degree markings may be placed in their proper positions with the aid of a protractor.

Contributed by

FRANK HARAZIM.

Foot Pressure Closes Switch

A safety switch, closed by the pressure of the foot, is illustrated in the accompanying drawing. In case the workman should receive an electric shock the withdrawal of his foot from the pedal immediately opens the circuit. This suggestion will find valuable application



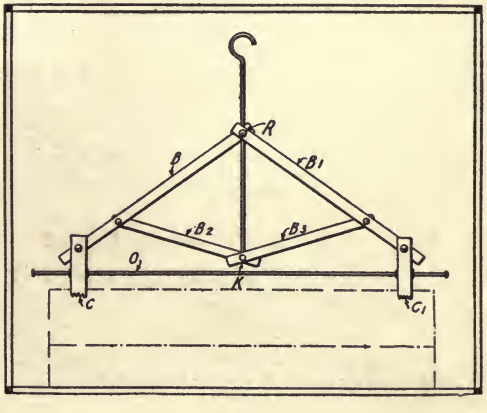
in laboratories where high voltage current experiments are carried on.

Contributed by

FRANK HARAZIM.

Improved Coat Hanger

An improvement upon the coat hanger which was described in these columns



in March is suggested by one of our readers. Instead of a hook for the coat and hat, a cross-arm should be nailed across the board and a wooden peg driven above it for the coat and hat, respectively. The rest of the construction is the same.

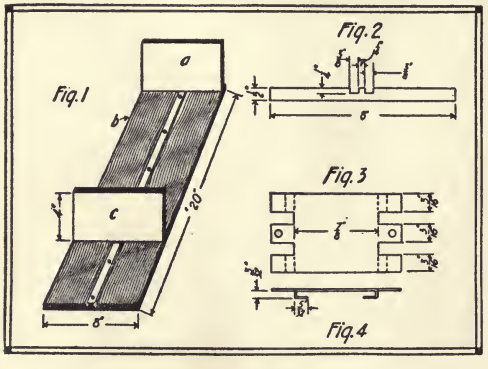
Contributed by

C. L. MACAULAY.

The Construction of a Book Rack

The book rack illustrated in the accompanying drawings was designed by the writer for filing copies of THE WORLD'S ADVANCE, and it has proved very satisfactory for that purpose.

The base of the rack, *b*, is made of hard wood and measures 20" x 8" x ¾".



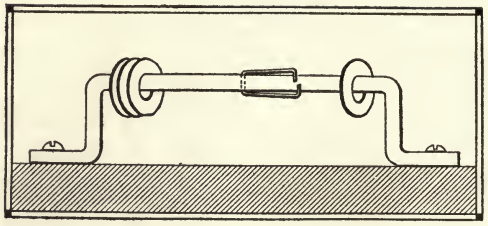
Two parallel grooves should be cut along the centre and a brass strip mounted along the track between them. One end rest, *a*, should be secured to the base with wood screws, while the other, *c*, slides along the track by means of the brass slider shown in Fig. 4. The end elevation of the base is shown in Fig. 2. Fig. 3 shows the slider before it is bent to the proper shape.

Contributed by

LESLEY BERGVALL.

A Counter for the Delivery Man

In counting the number of bottles of water or barrels or cases of other liquids which are delivered, a counter such as is used in billiard games will be useful. The counter consists of a long brass handle, fastened to the back of the delivery wagon and containing a number of washers. When one delivery is made a number of washers to correspond with the number of units of whatever sort are delivered are moved from one side of the handle to the other. To prevent them sliding back and becoming mixed when the wagon is under way, a small wire clip, inserted through a hole drilled in the handle and bent at the ends as shown should be added.



Contributed by

EARL B. WILLIAMS.

A Watch Case Calendar

The owners of hunting case watches will find it very convenient if the calendar for each month is inserted in the front cover of the watch. The calendars should be pasted in with flour paste so that they can be easily removed at the end of each month.

Contributed by

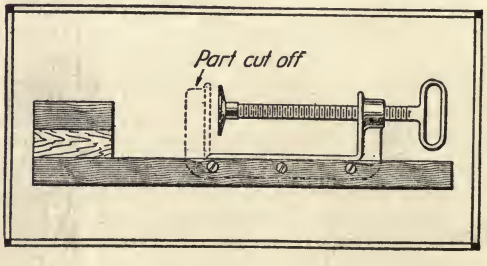
A. STANLEY WIENOLD.

An Enlarged Clamp

The scope of a clamp can be increased to an almost unlimited degree if the lower part is cut off and the frame bolted to a long wooden bar, one end of which is built up with several 2 x 4 blocks. These blocks should be securely bolted to the bar.

Contributed by

S. PENBERTHY.



To Anneal Steel Quickly

Tempered tool steel, such as files or drills, may be quickly annealed by heating the object to a dark red in a slow fire, cooling it in the air until the red color has almost disappeared, and plunging it into cold water. A few trials will be necessary before the correct cooling point is found.

Contributed by

F. M. A'HEARN.

Whites of Eggs for Pasting Labels

A good adhesive for fastening labels on bottles is fresh egg albumen. When dried, the label will not come off even in water.

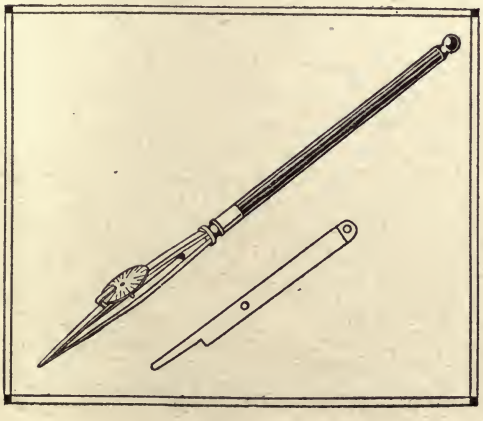
Contributed by

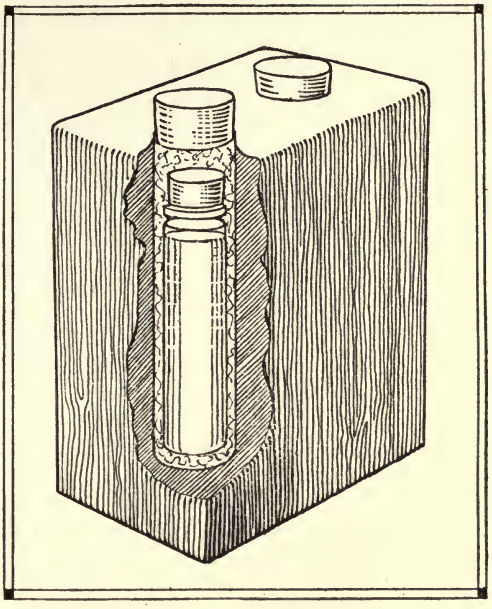
A HANDYMAN.

Index Wheel for Ruling Pens

If an index wheel of the following description is attached to a ruling pen, greater uniformity will result in the finished drawing. The wheel may be cut from sheet copper or brass. The index finger is also made of the same material. To assemble, the pen points should be removed from the handle and the regulating screw passed through the hole in the end of the index finger. The screw of the thumb wheel should be inserted through the central hole of the index finger and the pointer bent up over the index wheel as shown.

Contributed by C. H. PATTERSON.





Parcel Post Mailer for Small Tubes

Small phials can be safely mailed if they are placed in holes bored in soft wood and packed with cotton batting or sawdust. It should be remembered that liquids and explosives are barred from the mails.

Contributed by

FRANCIS W. NUNENMACHER.

A. C. Motor Troubles

An experience is cited here that may save amateur experimenters considerable trouble in doing welding on the rotors of alternating current motors. An armature of the "squirrel cage" type, having about 83 copper bars, had been welded on the resistance rings, using brass sputter and borax as a flux. When current was sent through the motor it failed to rotate, owing to the fact that the flux had flown under the bars and had insulated them from the rings. It was necessary to apply an extremely high heat to the brazing metal to run it out. Then the rings were turned up in a lathe and the bars filed to make contact. After this they were tinned and soldered to the rings, thus completely curing the trouble.

Contributed by F. W. LEHR.

A CRAFTSMAN SUMMER COTTAGE

Describing a Summer Dwelling that May Be Constructed by the Average Handy Man at Low Cost.*

By Ralph F. Windoes

Instructor of Manual Training, Davenport High School, Davenport, Ia.

Illustrations from drawings made by the author

WITH the main room framing completed, build up the lower part of the porch frame. Fig. 20 gives a detail of this framing in sections. The front should be made up first —upon the floor—in a manner similar to the framing of the main walls.

Select two 2 x 4's of the same length as the width of the porch for plates, and cut fifteen 2 x 4's that are 32″ long for studs. Nail them in place 24″ on centers, and double at the ends. Set this frame up, and spike it to the floor. It will not be necessary to brace it, because of its short height.

Next, frame the right side in exactly the same manner, and toe-nail the ends of the plates onto the front and the double corner of the main frame.

The left wall frame will be made a little different, as the screen door must be provided for. Notice that the two long studs do not have a plate on their upper ends, as this plate will be placed when the upper section is built, but they must be held, temporarily, with a diagonal brace to the main wall frame. When fitted in place and secured by the upper section plate this brace will be removed. Fit the studs and the header around the screen door frame, exactly as you did before, allowing a little clearance on each side. When ready, raise the frame and securely nail it in place.

Fig. 21 gives a detail of the three columns supporting the front of the upper section. Each is built up of 2 x 4's dressed on all sides and carefully nailed together. Two blocks 1¾″ square are nailed to each end, the upper to serve as the abacus, and the lower, the plinth. When ready, nail these in place on the front plate, as seen in Fig. 22, and brace them so that they are perfectly plumb and in line.

Upon the upper ends of these columns must rest the header that supports the roof. It is nailed up from the two 2 x 10's, and is cut as long as the plates of the lower section. Spike these planks firmly together, and straight on both edges. Carefully raise it into position on the posts, and toe-nail it to the abacus of each post.

The next step will be the framing of the porch roof, using the 18-foot 2 x 4's for the rafters. This framing problem is so simple that a detailed description is hardly necessary. Each rafter at the high end is fitted over the plate of the main wall frame, and at the low end over the porch header, as illustrated in Fig. 23. Run the upper end about one foot past the plate and nail each rafter to a corresponding rafter of the main roof. At the lower ends, cut the rafters with a 12-inch lookout. Spiking this end firmly to the header will complete the roof framing of the porch.

Next, frame the upper sections of the porch, as detailed in Fig. 24. First nail the plates across, toe-nailing their ends into the double studs of the main frame, and the porch header. These plates must be straight and level. The left side plate, of course, will rest upon the upper ends of the long studs already in place, and will be nailed to them.

Between each plate and the outside rafters, nail in the studs. They are cut at the upper end in the same manner as the studs in the main frame, excepting

* This article is one of a series that has appeared in every issue of THE WORLD'S ADVANCE, beginning with the May number. The series is completed with this instalment.

The Craftsman Summer Cottage, as it Appears when Completed. In Order to Derive the Greatest Pleasure from the Possession of Such a Dwelling, the Site Selected Should Preferably be Near a Lake or River.

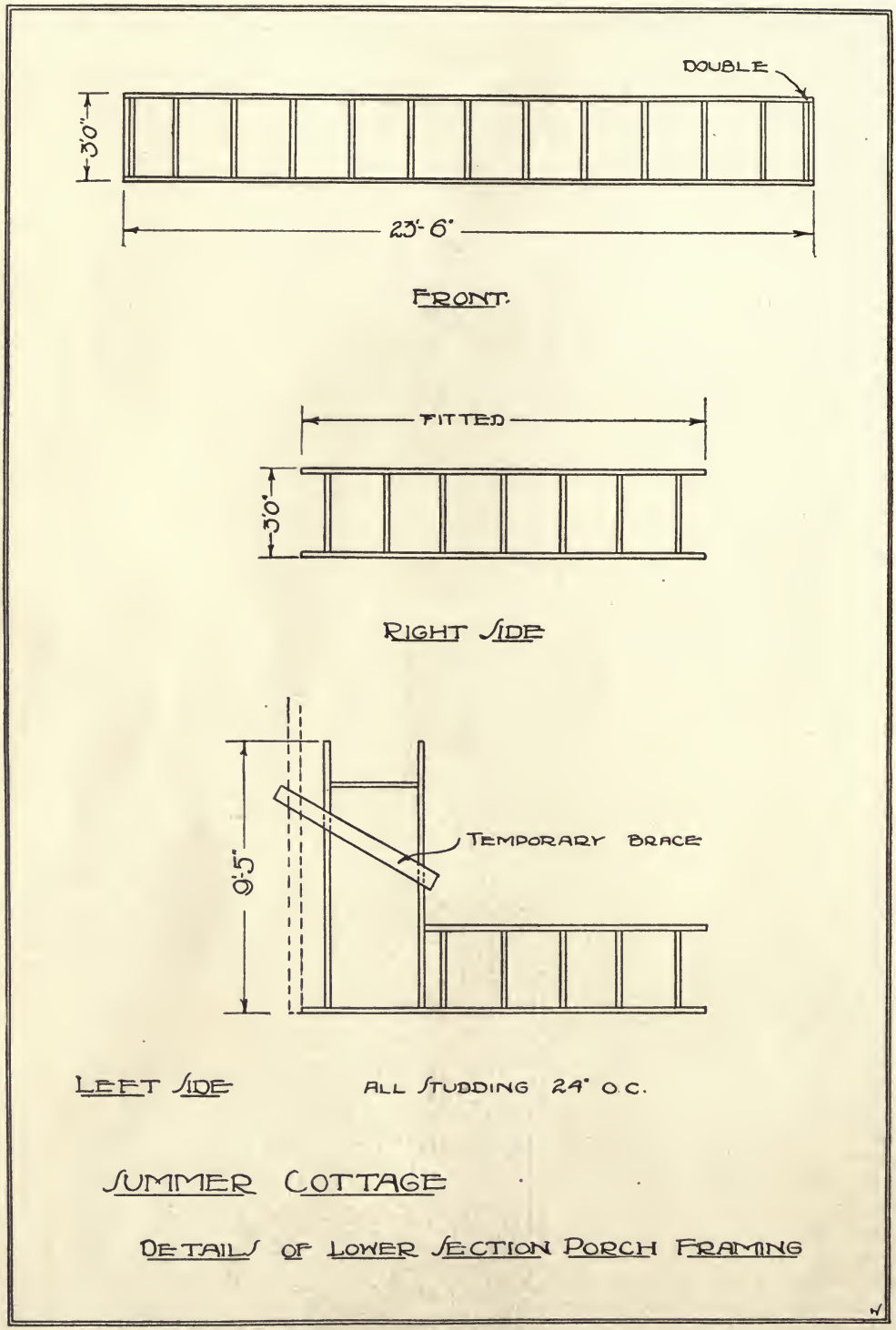


Fig. 20.—Constructional Details of the Lower Section of the Porch Framing.

that the cut will be on the inside instead of on the outside, as in the former case, as all studding must be in line. When this much has been completed, your porch framing is finished.

The framing of the kitchen is very similar to the work already undertaken. The rear wall is framed, as detailed in Fig. 25, raised into place, and firmly braced. Next, the rafters are cut and fitted exactly as was done with the porch roof, and the side wall floor plates are laid. The studs are built in, as before, allowing clearance for the door and window frames. Fig. 26 gives a detail of each section of this framing.

With this much accomplished, you will be ready to begin the finishing. First, put on all of the drop siding, working from the bottom toward the top of the structure. The first boards laid should be very nearly straight, and their lower edge, which will contain the

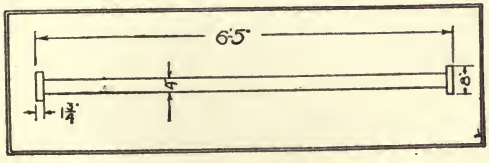


Fig. 21.—Detail of a Porch Column.

groove, should extend a little below the lower edge of the sill plate. This is to allow all rain to drip to the ground without working under and rotting the sill members. A detail of this finishing is given in Fig. 27. In breaking joints, try to bring the ends of the boards where the casings will cover them, as illustrated in the elevations in the opening chapter of this series. If this is impossible without wasting a great deal of material, be very sure that the butting ends are sawed square, and each joint comes over a stud. Fit around each opening, flush with the inside face of the studding, and carry the siding up to the top edge of the end rafters. The lumber bill calls for enough

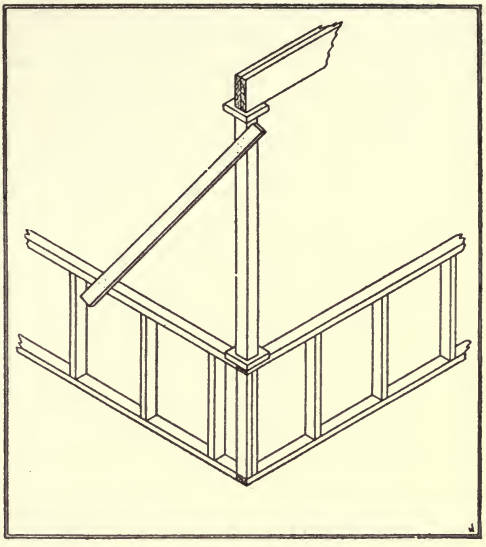


Fig. 22.—Porch Framing Detail.

material to cover the partition between the living room and the kitchen, applied from the kitchen side, but if the craftsman decides to cover his walls with wall board, as suggested at the end of this instalment, of course this siding must be omitted, as all sides of the kitchen should be covered alike.

Next, drive the pump pipe in the kitchen, as the upper end—while driving—must project through the roof, and the roof boards would interfere if they were to be laid first. At the point in the floor where your pump will stand, bore a hole large enough to admit the 1¼" pipe and coupling. Attach the drive point to the lower end of the pipe, and the drive cap to the upper. Insert the lower end through the hole and allow

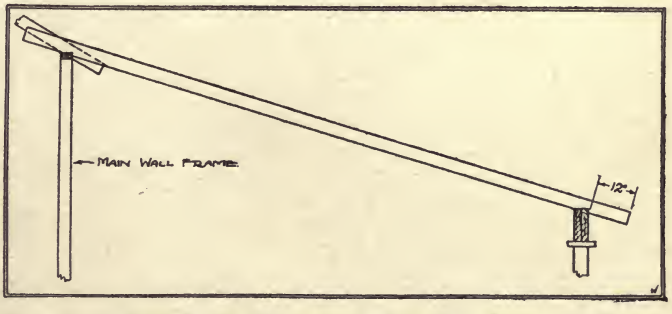


Fig. 23.—Detail of Porch Rafter Framing.

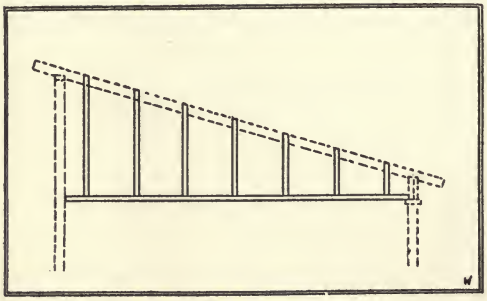


Fig. 24.—Detail of Framing of Upper Porch Section.

the upper to project straight through the rafters. Fastening and securely bracing your 18-foot ladder so that you can use it to conveniently reach the upper end of the pipe, carefully drive the point into the ground. Using the ladder to stand upon, you are thus enabled to descend, as your pipe is driven down. When it is the proper distance from the floor, remove the drive cap and drop a string down the pipe with a weight attached. Leave it for some little time, as the water might be slow in entering on account of the dirt in the perforated jacket. If, upon withdrawing the string, the lower end is wet, you have probably gone deep enough. Generally, being near water, 20 feet is sufficient unless the cottage is built upon a very high elevation. Attach the pump, prime it, and give it a try-out before leaving this important part of the equipment.

Next, put on the roof boards, just as you did the flooring, allowing them to project out on each side one foot for a cornice. Cover with the rubber roofing, *according to the directions of the manufacturer found upon each roll,* turning the outside edges under the cornice and securely fastening them; also the ends at the lower edges of the roof.

Build the bracket in the kitchen to carry the chimney, next, as illustrated in the left side elevation in the May instalment. Carefully cut a circular hole in the roof above this bracket, and place the tile, large end down. The lower end of the T-branch should be filled with a rich cement mixture, also each joint. Strengthen with the wire guys to the roof, and fit the rubber roofing very snug around the pipe, using plenty of roofing cement to make a good job of it.

Fit all door and window frames into place, and nail them securely to the siding and the studding. Next place all casings, the frieze, water table, etc., as illustrated in the elevations and in Fig. 27. Be sure that you make neat, sharp joints where the various pieces join. A good way to do this is to saw a bit outside of the pencil line, and plane down to it, constantly trying the piece in position. The upper end of the water table is to be planed to an angle of 45 degrees, so as to guide the water away from the building.

Fit the windows and doors very carefully into their respective frames. Take a great deal of time for this important part of the building, as a poor job of fitting will reflect discredit upon the builder as long as the cottage stands. The kitchen and balcony single-sash windows are hinged at the top, while at the bottom they are fastened with the transom catches. The other windows have the spring bolts inserted through their sash with holes bored into a number of positions in their frames, these holes permitting the windows to be raised to various heights. The doors are all to be equipped with the lock sets, and the screen with its attachments.

There are a number of odd jobs left such as the placing of the sink with its drain pipe, building the balcony ladders, the porch seats and the steps. As these tasks are so simple for the craftsman who has just built a complete structure,

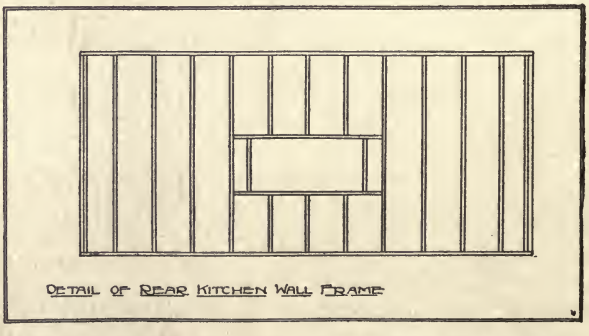
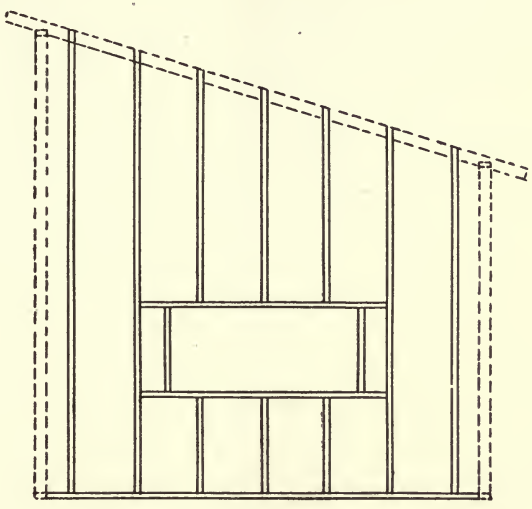
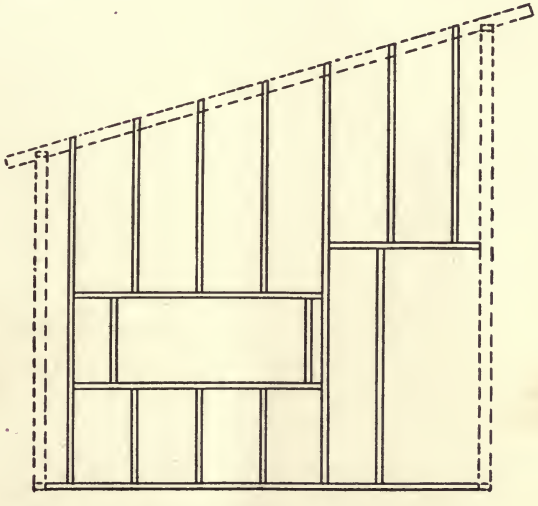


Fig. 25.—Arrangement of Framing for Rear Kitchen Wall.



RIGHT SIDE



LEFT SIDE

SUMMER COTTAGE

DETAILS OF KITCHEN WALL FRAMING.

Fig. 26.—Framing for Kitchen Wall.

we will not take the space to detail them.

Now to paint the cottage: Select a dry day and be very sure that the wood is clean and free from all moisture. With the small can of shellac, well shaken up, cover all knots and bad, sappy places, as the pitch from these is liable to work through the paint. When this has dried thoroughly—it will only take an hour or so—apply the priming coat. This is mixed from the two gallons of gray prepared paint, thinned out with the gallon of boiled linseed oil. Stir the mixture until it is perfectly even and rather thin. Use a wide brush, four inches or over, and cover the entire structure, including the casings and the porch floor. The priming coat should not be heavy, but it should be brushed out well.

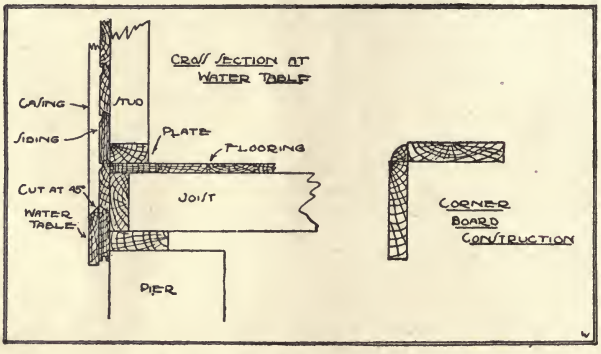


Fig. 27.—Details of Exterior Finish.

From four to six days should be allowed for the first coat to dry. Do not thin the paint for the second coat, but stir it up constantly. Apply the body color and go over the second time with the trim. The black sash paint is carefully applied with a small brush, preferably flat, and is put on before the porch paint.

Finally, attach the wire screen cloth around the porch and cover the window openings. If the craftsman has the time, and so desires, it would be a good idea to build frames for the screen, which would fit in between the posts on the porch, also in each window. They could then be taken down and stored inside during the winter, which would greatly prolong the life of the screen.

This practically completes the structure as originally planned, with the exception of the curtains, as described in the opening instalment. They are made to slide on wires so as to be out of the way in the day time.

Of course, the inside of the cottage will have a rather crude appearance with no casings or wall covering, so if the craftsman cares to add a little more to its comfort, and, incidentally, to its expense, it would be advisable to cover the walls with wall board, and put on casings of yellow pine. The additional expense would be about $50, depending, of course, on the kind of wall board purchased.

If Mr. Curtis's articles on the lighting of the cottage are taken advantage of, it would be advisable to wire it before putting on the wall board. It might be a good plan to wire it anyway, even if the cost of a lighting plant prohibits the use of the lights at first, as it will be much easier to run the wires when the framing is open.

Furniture especially suited for making the summer cottage both comfortable and attractive will be described in the September issue of THE WORLD'S ADVANCE.

WHAT HAPPENED TO AN OWL

One evening not long ago a great horned owl alighted on one of a pair of conductors carrying an electric current of 20,000 volts in the neighborhood of Montreux, Switzerland. He knew nothing of what was passing under his feet, and would have been safe had he not idly stretched out one of his great wings, more than two and a half feet long, until it touched the other conductor. Instantly all over the region supplied with electricity by this line people found themselves plunged in darkness. When the cause of the short circuit was investigated, the body of the big bird was found with the head burning on one wire and the wing on the other.

THE illusion about to be described, although embodying several old principles in the art of magic, nevertheless produces a very startling effect on the average audience. The presentation is as follows:

The performer first directs the attention of the audience to a cabinet which is about four feet square and mounted on roller casters. The cabinet is then placed on a small platform so that it can be revolved and at the same time it can be proven that no trap doors are used. In the center of the cabinet is placed a row of electric lights mounted in front of suitable reflectors, and extending from top to bottom. There are also two doors placed on the back of the cabinet which serve the purpose of proving to the audience that the cabinet is empty.

The row of lights is illuminated and the performer, stepping inside the cabinet, holds a piece of black cloth so as to hide the front, but as he is thus holding the cloth a form is seen to shape itself in the cloth and a moment later the person thus produced steps down from the cabinet and crouches in front of the footlights, with the cloth still over him. Another piece of cloth is taken and a second person produced in a similar manner, followed by a third. The performer's lady assistant then steps into the cabinet and also produces a person in the same manner as the performer. She then steps from the cabinet, whereupon the two rear doors are opened and the cabinet revolves, thus showing it to be empty. The wonder of the trick is that the audience has been able to see beneath the cabinet during the entire time, and that the cabinet being placed ten feet or more in front of the back curtain has rendered it impossible to place a plank from the rear to gain access to its interior.

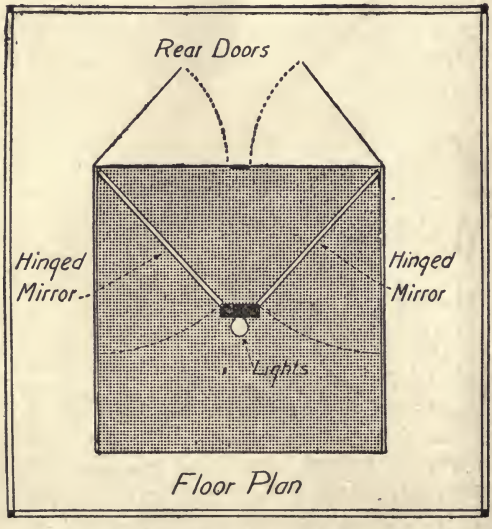
After the cabinet has been proven empty, the performer steps into the cabinet, which is then given a turn, and as the front of it meets the eyes of the audience the performer is missing. His lady assistant then vanishes in the same manner. At this point of the illusion another assistant fires a pistol and, to the amazement of all, two of the figures previously produced from the cabinet jump up and throw off their cloths, and prove to be the performer and his assistant.

As mysterious as the illusion may seem, it is very simple to produce, the main requisites being two substitutes—one for the performer and the other for the lady assistant—and two mirrors. The interior of the cabinet must be lined

with some dark cloth. The row of lamps serves to hide the fact that at this point the edges of two mirrors come together, the opposite edges being hinged to the rear corners. When the mirrors are in their normal positions they reflect the sides of the cabinet, therefore deceiving the audience into believing that they can see the back of the cabinet. The backs of the two mirrors are lined with the same kinds of cloth as the inside of the cabinet.

At the beginning of the illusion the mirrors are placed so as to reflect the sides of the cabinet and behind them four people take their places; two being the ordinary assistants while the other two are the substitutes and are made up to resemble the performer and his lady assistant as closely as possible. This is very easily accomplished if the persons are of the same build. When the performer holds up the first two pieces of cloth, the assistants push open the mirrors and take their places beneath the respective cloths. However, when the performer holds up the third cloth his double takes hold of the cloth while the performer stays under the sheet and thus hidden from view steps down to the footlights with the two assistants. The lady assistant then takes her place in the cabinet, going through the some procedure as the performer. When the lady's double takes hold of the cloth the two mirrors are pushed over to the sides of the cabinet where they are held by small metal clips. Thus the two rear doors can be opened and the cabinet freely shown. After the cabinet has been shown the performer's double steps into it and while the cabinet is being turned he closes the mirrors and steps behind them, hiding himself from view. The lady's double then follows suit. Thus, when the pistol is fired it is a very simple matter for the performer and his assistant to jump up and throw their covers off, bringing the illusion to a very striking climax.

To obtain the best results the illusion must be worked with snap and energy. It is a very good idea to have the assistant do most of the work so as to have the attention of the audience diverted from the performer and his collaborator.



Plan View of the Cabinet for Performing the Illusion.

NAPHTHALINE AS MOTOR FUEL

The war blockade is forcing Germany to save her store of gasoline by developing acceptable substitutes for motor fuel. The distillation of coal tar gives her great quantities of benzol, and when this is properly purified it can be used without a bad deposit of carbon in the cylinders. The Feld process of distillation now used in Germany furnishes the desired grade of benzol.

Naphthaline, another product of coal tar distillation, is receiving much experimental attention in Europe. At present it has no use except as the base for about twenty million dollars output of artificial indigo and a very limited use in the form of moth balls. Germany alone makes 175,000 tons of naphthaline every year and she has already demonstrated that with special apparatus for making an explosive mixture with air, melting the solid, of course, at 79 degrees Centigrade, power may be obtained at an extremely low cost.

If you enjoy THE WORLD'S ADVANCE, tell others; if not, tell us.

Electric Lights for the Summer Cottage*

IN the selection of a generating equipment for the charging plant of the summer cottage, the worker has a number of options. For instance, he may investigate the claims made for the many small generating units consisting of dynamo and gasoline engine either direct connected or belt driven. While these little plants are perhaps high in price for our purpose, still they have many features of merit which commend them to the notice of the amateur engineer in charge. On the other hand, the ingenious man may couple together a small engine and dynamo, mounting them on a single wooden base, and perhaps get quite as satisfactory results as the other fellow who put a hundred or two into a regulation plant. This article is intended for the handy man who, for some reason or other, scorns the idea of purchasing the plant complete, and who wishes, perhaps, to pick his engine from some place near the junk heap and to rewind an old fan motor to make his generator. This very thing has been done, and that more than once within the knowledge of the writer.

To this end, therefore, let us consider the amount of electrical energy necessary to charge the battery and after that the horsepower required to get this energy out of the dynamo.

The battery suggested in former articles is of a capacity ranging from 80 to 100 ampere hours and its charging rate is in the neighborhood of 10 amperes for from eight to twelve hours. A generator having a capacity of 100 watts will do the work if this capacity is actual as well as theoretical. The voltage should be in the neighborhood of eight or nine and the machine should be capable of standing a continuous run of twelve hours, delivering a current of ten amperes without overheating either in the windings or the bearings. Perhaps the most prolific source of trouble in the small machine is found in the bearings, which are seldom well designed and frequently without adequate oiling facilities. Of course, the ideal generator for our purpose is one of the standard automobile lighting and charging type. It is likely that the cost of a new one will scarcely be justified, and, unless the worker is able to buy a second-hand generator in good condition, it is probable that he will be obliged to have recourse to a dynamo of inferior design.

In the writer's experience one of the most satisfactory small generators available is one made from a rewound small-power motor. The case of a one-eighth horsepower machine of this type is recalled. The motor was picked up in a junk shop at a price commensurate only with the iron and copper in it, and, while the windings were quite worthless since they had been literally burned up, still the frame, bearings, armature and commutator were in excellent shape after the dust and oil were cleaned off. The machine had originally been wound for 110 volts and of the shunt type. In removing the winding, or rather its remnant, the sizes of the wire on armature and field were carefully noted and in rewinding there was used a wire having ten times the area of the original one. The carbon brushes of the motor were displaced by ones of copper gauze and

* Continued from the July number.

the small pulley exchanged places with a larger one having a flange to serve as a balancing flywheel. After an initial charging of the field by connecting it to the ignition battery of the engine, this little piece of junk started generating without the slightest difficulty and for all the writer knows it is still working, although at this writing the machine has been out of his possession for a matter of five years. On a slight overload the fields would run warm, and in order to cool them a crude fan was attached to the pulley inside the rim. This completely obviated the difficulty, and after its adoption the generator would deliver for half an hour at a time more than twice the current it was intended to supply, without developing serious heat.

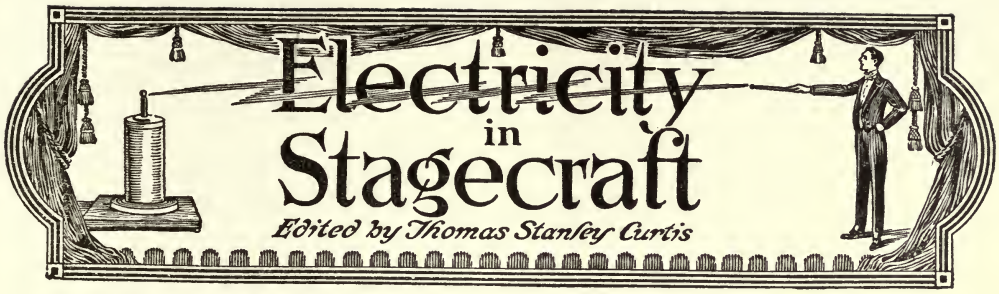
The remarks in the last paragraph are given solely with the idea of offering a suggestion to the handy man who feels that he is courageous enough to attempt the rewinding of an old machine. The principal point to look out for in the buying of such a machine is the form of lubrication and the size of the shaft and bearings. The conventional wick oiler so frequently found in small motors is quite satisfactory if the proper lubricant is used and assuming, of course, that the wick is held against the shaft by means of a spring of the correct strength. The ideal oiler is the ring type, and if the machine is so equipped the worker need not look much further beyond ascertaining whether or not the bearings are fairly snug and the shaft in good condition. A machine equipped with ordinary oil-cups or oil holes in the bearings is nine times out of ten a poor buy except for purely experimental work. So much for the dynamo.

If the worker is fortunate enough to have a small stream on or near his place, three-quarters of his problem is solved. The amount of water power needed to turn a 100-watt generator is so small that the crudest type of waterwheel will answer in most cases. This question of water power is brought up at the present point before the selection of a gasoline engine is suggested, and water power in the case of the summer cottage is, in more ways than one, ideal.

If the water power is found to be unavailable, however, the worker had best resort to the gasoline engine. In this event the plant would be housed beneath the seat on the porch. The engine need not be larger than a half or even a quarter horsepower if the rating is honestly given. Air cooling is satisfactory if the machine is properly designed and equipped with a cooling fan, but a water-cooled machine is to be recommended if available. There is little choice between two and four-cycle machines, but in either case the engine should be governed closely. A new engine is advised unless a second-hand machine can be obtained from a responsible dealer who will guarantee the condition of its valves, bearings, cylinder and piston. In the internal combustion engine these parts are subjected to strains that weaken the output of power without materially affecting the running qualities of the engine when the load is off.

Assuming that the dynamo and engine have been obtained, the worker may proceed to assemble them, preferably on two substantial struts of wood, the dynamo being so mounted that it may be slid forward or backward to tighten or loosen the belt. The skids may rest on thick pads of rubber or felt fastened to the porch floor, or, better still, four upright posts may be set in the ground beneath the porch, passing up through its floor without touching, to afford a substantial foundation for the little plant, which is thus independent of the cottage, although housed by it. The vibration is likely to be annoying unless some provision is made in this manner to absorb it.

The belt from engine to generator should be long and pliable; a tight, short belt has no place here. The gasoline should preferably be kept in an underground tank a short distance from the cottage and fed under slight air pressure through copper tubing to the engine. The voltage of the dynamo should be made variable through the insertion of a small rheostat in the field circuit. The leads from the dynamo are secured to the right-hand poles of the switchboard shown in the preceding installment of this series.



The Preparation of an Electrical Act in Vaudeville*

"A Million Volts Through the Body"

FOR several months past there has appeared in this department a series of articles describing the construction and use of electrical apparatus designed for the production of spectacular experiments with the electric current. The assembly of the entire apparatus as described would entail a considerable expenditure of time and money and there are cases where this outlay would scarcely be justified. For instance, the platform lecturer would scarcely care to burden himself with the cumbersome and expensive equipment so essential to the performer on the stage. For the benefit of the readers to whom the elaborate outfit does not appeal, the present article will give a summary of the various instruments necessary for the successful presentation of both the big vaudeville act and the modest lecture as well, pointing out how the cost or weight may be cut down here and there.

The one big feature of any electrical act is the high-frequency work. This fact is admitted by dozens of performers and lecturers alike. The very idea of taking thousands of volts of electricity through the body and still living to tell the tale is theatrical in the extreme, and it is no wonder that so many so-called electrical kings separated a gullible public from their dollars for years on the sole claim that a supernatural or other unusual power made it possible for them to take the enormous voltage through their bodies. The high-frequency coil may therefore be regarded as the one essential part of the outfit, and the other instruments more in the light of accessories.

The coil described in recent articles will deliver a spark several feet in length. That this is spectacular and impressive no one will deny, but the outfit weighs hundreds of pounds and requires for its operation several kilowatts of electrical energy. The utter uselessness of such apparatus for the small lecturer is at once apparent. Far better it is for him to make or purchase a small coil capable of giving an eight or ten inch spark and taking its current from the nearest lamp socket. Furthermore, the large apparatus requires for its operation an alternating current, and this is not always obtainable. The only practical alternative is a rotary converter which in this large size is heavy and expensive. The small coil may be made on the "kick-back" principle, and in such event its operation is equally satisfactory on either direct or alternating current through the change of a simple connection.

The question of the high-frequency

*This article is one of a series that has appeared in past issues of *Modern Mechanics* and THE WORLD'S ADVANCE since September, 1914. Previous instalments have covered the construction of the apparatus referred to in this article. The series is completed in the present issue. The demand for the back numbers has been so great that several issues are now out of print and can no longer be supplied. The author has in preparation, however, a very complete book dealing with this subject in a thorough manner and interested readers may obtain information relative to the work through our Book Department.

outfit therefore resolves itself into one of whether the performance is to be given in a chain of small lecture halls or good-sized theatres. In the former case the small portable outfit is ample and certainly far more useful, while the latter use would justify the best aggregation of paraphernalia the capital of the owner would command. The salaries of feature vaudeville acts are, as a rule, commensurate with the pulling power and therefore the attractiveness of the act itself. Recognizing this, it is certainly wise to put forward every effort in an endeavor to make the true vaudeville act as big, as spectacular, and, to sum it up, as impressive as may be possible. The results justify the expenditure.

In the construction of the apparatus the average reader is face to face with a problem. The manufacturer of standard apparatus will not even quote on this special material; the model shop wherein inventions are developed is too thorough and expensive; the average electrician knows nothing whatsoever about the apparatus in question; the typical machinist is worse than useless where complete assembly is concerned, as he is either too "rule of thumb" or too literal. The reader will wonder what he is to do. The answer is to build a home workshop. It is cheaper in the beginning and in the end, and if the apparatus is worth having and building, it is deserving of a proper birth place. The tools required may be purchased for perhaps a quarter of the sum demanded by the combined carpenters, machinists, electricians and the rest of the vast army of mechanics, each one of whom does not know just what is desired, but is certain that he is capable of building it just the same.

The construction is best done in a spacious room wherein the apparatus can also be set up and tested, and the act rehearsed. This means, of course, the installation of electric service. The room should have plenty of open floor space rather than spacious work benches, although these are quite as essential within reason. The tool equipment may consist of a fairly complete set of woodworking tools and bench, an engine lathe of light construction but of large capacity as regards swing, a small drill press and complete set of metal tools, such as pliers, hacksaw and files. With such an equipment the handy man—and it is assumed that the would-be entertainer is a handy man or he had better not start on the road with his outfit—may construct the entire set of apparatus with the assistance of a bright boy or even girl if she be mechanically inclined. And after the apparatus has been built by the man who intends to use it, who can gainsay the fact that he, better than anyone else, is prepared to take care of it and repair it if necessary? If some of the more intricate machine work, of which there is little, is beyond the capabilities of the amateur, then let him go to the regulation shop and have just that part finished up to drawings.

The question of drawings brings us to a point of vital importance. Before a stroke of work is done on the apparatus, each and every part should be depicted in a large drawing and all dimensions checked to determine their accuracy. The space available in this magazine has not rendered it possible to cover this detail with any thoroughness, but the individual worker should develop his design from the suggestions given, making his drawings complete in order that he may fully understand the construction of the various parts. For the convenience of those who do not feel capable of developing these drawings, the author of this series has prepared a set of detailed blueprints showing the construction of the apparatus as a supplement to the articles.*

In no sense is the work of building the apparatus difficult and neither does it require the services of skilled labor. The ability to use tools in an intelligent manner and, what is far more important, a fairly intimate knowledge of the apparatus being built, may be said to constitute the qualifications for success. In order that the latter qualification may be obtained, it is suggested that the prospective builder diligently consult every book pertaining to the subject that he can lay his hands on. These books may be numbered on the fingers of one hand,

(*Continued on page* 246)

*These blueprints may be obtained at a moderate price through our Book Department.

Practical Electro Therapy

Edited by Thomas Stanley Curtis

High Frequency Apparatus*

THE production of a highly concentrated heat in certain areas of the body is desirable at times in the practice of electro-therapeutics, and to make possible this localized application a special form of current is supplied by the modern apparatus.

THE THERMO-FARADIC CURRENT

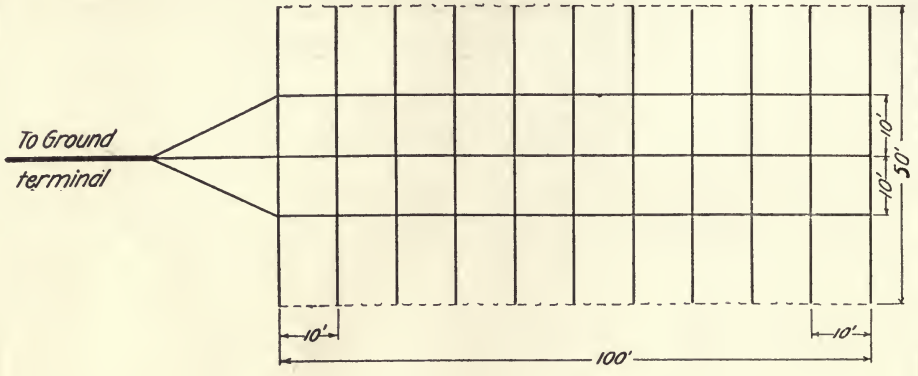
The thermo-faradic current is in effect a true D'Arsonval current of comparatively low potential but very high frequency and comparatively large volume. The name thermo-faradic is suggested by the pronounced thermal effects together with a slight sensation of muscular contraction, particularly when the frequency is lowered slightly by an adjustment of the frequency regulator on the coil. So effective is the current in the production of local heat that the hands grasping the electrodes may become covered with perspiration and the wrists acquire a sensation of warmth, which increases to a degree where it may become unpleasant if treatment is prolonged. Incidentally, an interesting experiment that illustrates the heating effects in a graphic manner may be performed by placing a piece of metal on either side of a beefsteak and connecting the thermo-faradic terminals to the metal plates. The application of the current full force will shortly serve to actually cook the steak. Notwithstanding this evidence of the potential possibilities of this form of current, it is probably the safest of all the high-frequency modalities to apply. The danger of shock is quite absent, and the discomfort of the patient would soon manifest itself if the heat were to become too great. This symptom would be merely an indication that the electrodes should be moved or the current reduced.

The thermo-faradic current is best applied through the agency of large metallic electrodes which may either be placed in direct contact with the area to be treated, or, what is perhaps better, the electrodes may be wrapped with bandage and padded with cotton in order that the application may be made through a saline solution with which the bandage is saturated. Another approved method is to apply sheets of heavy tinfoil to the desired area, bending the metal so that it may conform with the shape of the part under treatment. The movable moist electrodes are probably the better, however, as their positions may be changed at will when the heat becomes too great in one spot. In the application of the current the operator should use great care to see that the electrodes are in absolute contact with the patient at all times when the current is passing; the separation of the electrode from the body for even a fraction of an inch would give rise to a spark which would be rather painful and startling to the patient, although beyond this it would have no serious consequences whatever. If the precaution is taken to see that the contact is good when the current is turned on and continued good until the switch is opened, there will not be the slightest cause for concern.

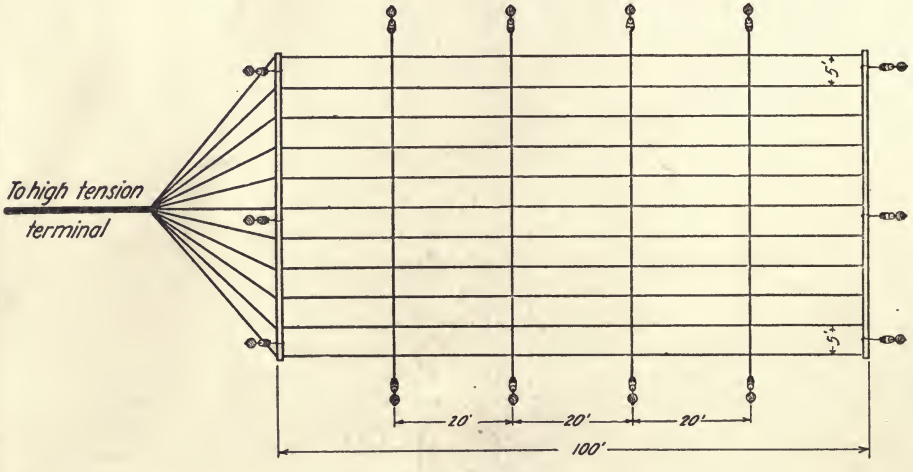
The use of the thermo-faradic current is particularly indicated in cases of sprains and chronic arthritis.

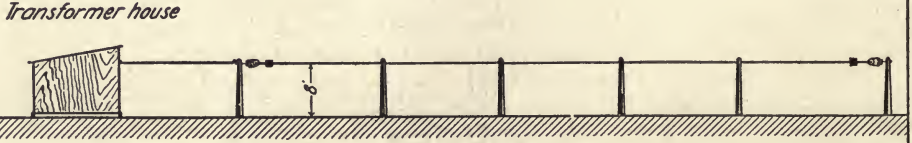
* This article is the sixth of a series on high frequency apparatus. The first article appeared in the March issue of *Modern Mechanics*.

Plan of Ground Wires



Side Elevation and Plan of Overhead Wires





Electricity in Horticulture
Edited by Thomas Stanley Curtis

Plant Culture by High Frequency Current*

Part VI. Wiring the Plot

THE high-frequency current produced by the apparatus described in past articles is administered to the plot of ground under cultivation through the agency of an overhead network of copper wires and a ground connection consisting of strands of wire buried in the earth of the plot. The transformer house is preferably located at one end of the plot in order that the high-frequency current may be carried to the area under cultivation by the shortest possible route. This is highly desirable, as an appreciable loss would be sustained in a long transmission line.

The equipment recently described is of sufficient power to cultivate a plot of ground embracing 5,000 square feet, and in the case under the writer's observation the plot measured 50 feet in width by 100 feet in length. The ground wires, three in number, were run the entire length of the plot and spaced ten feet apart. Crossing these wires at ten-foot intervals were ten bridging wires arranged as shown in the illustration and soldered at each joint. In all cases the wire was of No. 16 bare copper. At the end of the plot nearest the transformer house, the ground wires were brought together in a rat-tail and connected with the ground lead of the apparatus.

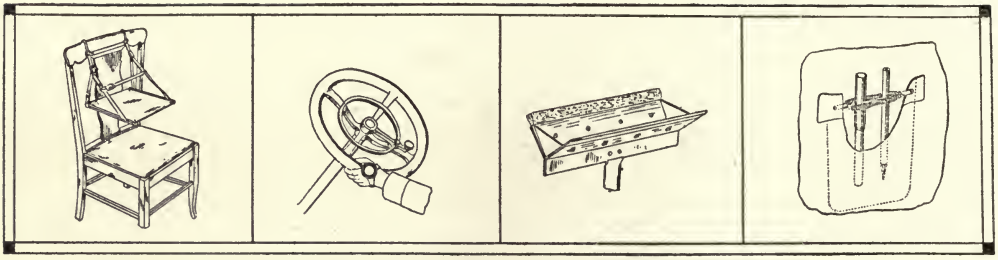
The overhead network presents a more difficult problem. In the experimental plot ten wires spaced five feet apart ran the entire length of the plot and were supported at either end upon high-tension insulators held by posts which were of such a height that they suspended the wires seven feet above ground. At twenty-foot intervals on either side of the plot, additional posts were located and cross wires between each two of these posts completed the network and at the same time relieved the strain upon the slender wires running the length of the plot. As in the case of the ground network, all joints were soldered. The overhead connection is in the nature of a continuation of each of the long wires to form a rat-tail, grouping all of the wires where they are connected with the high-tension lead passing through the glass window of the transformer house.

The insulators on the posts may be of the conventional glass high-tension type or they may be cobbled up by grouping a series of porcelain cleats as suggested in the appended illustration. The best of insulation is none too good, particularly in damp weather, as the high-tension current leaks badly in its effort to find its way to the ground.

The actual time of treatment will naturally rest with the individual investigator. From one to four hours, both night and morning, is a fair dosage, and noteworthy results have been obtained with this average treatment. The plants or vegetables under cultivation should be planted in duplicate in a neighboring

(*Continued on page 246*)

* This article is one of a series dealing with various methods of electrical plant culture that has appeared in this publication since September, 1914. The various instalments have dealt with the different methods of applying electricity to horticulture, as well as described the construction of the apparatus required. Back numbers may be secured at 15 cents each while the supply lasts.



Recent Novel Patents

High Chair for Children

An apparatus which can be attached to the back of an ordinary dining-room chair and convert it into a high chair suitable to children, is the subject of a patent recently granted to an inventor of Ohio. The device consists of a stout board fitted with several straps which serve as braces and supports to hold the child in place. These straps pass over the back of the chair and are buckled behind.

Hand Mirror for the Motorist

A convex mirror, to be attached to the back of the hand, and whose purpose is to show to the driver of an automobile the condition of the traffic behind him, has been brought out by a Chicagoan. The mirror, which is quite small, is attached to the back of the hand by means of three straps which converge at a point in the centre of the palm. The advantage of the mirror is that it does not interfere at all with the freedom of the chauffeur's hands, and is at the same time always convenient.

An Improved Window Scraper

A decided improvement upon the usual type of window cleaner, or scraper, which consists of a rubber lip held at the end of a long handle, has been invented by a man in Georgia. It consists of a long, shallow trough along one side of which is fastened the customary rubber lip for scraping the moisture from the surface of the window. In the ordinary type of window cleaner the moisture drips from the rubber, but in the new one the trough catches the water.

Pocket Pencil Holder

Two light coils of spring wire, which stretch across a vest pocket to hold pens and pencils in place, is the subject of a patent recently granted to a man in Massachusetts. The ends of the coils are fastened to the inside of the pockets and the pens and pencils are thrust down between them. Half way between the ends of the coils a joint is made, its purpose being to give more rigidity to the hold which the coils have upon the pens and pencils.

Combined Table and Settee

A broad settee, which in the twinkle of an eye can be converted into a broad, solid table, has been patented by a New York inventor. Unlike its prototype, the innocent looking centre table, which can be changed by a hand twist into a poker table, or vice versa, this invention is intended for purely domestic purposes, where space is limited. The table top, when not in use, slides and folds back of the seat by means of an ingenious arrangement of hinges. To convert the bench into a table, the back board is swung up and over, fitting in grooves cut in the arms.

Chain-Engaging Machine

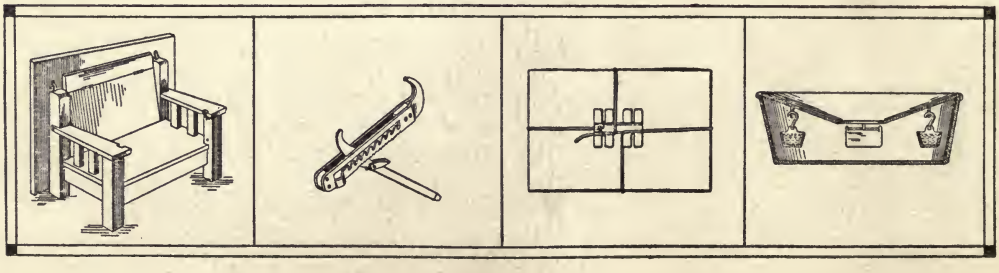
A chain-engaging tool by means of which a tremendous amount of leverage is gained in handling large chains has been patented by a Detroit man. The tool is provided with a heavy hook at one end and along its sides are riveted notched tracks. A bar is inserted through a long slot in the centre of the machine through which a bar passes, having a pin and rachet by means of which the chain is advanced. A hook is fashioned on the end of the bar.

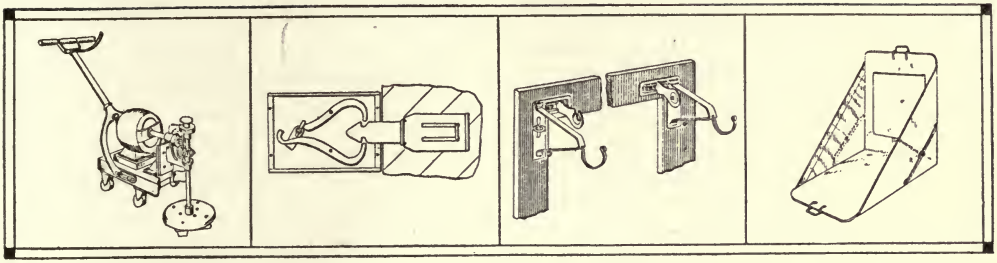
Saves Time Tying Packages

A package tying device, which will probably be of interest to mail order houses and magazines, is the subject of a recent patent. This device consists merely of a stamped fibre piece containing a number of slots into which the cord passes.

Sanitary Cuspidor

A cuspidor, containing a self-disinfecting apparatus, is the latest word in sanitation. Outwardly it resembles the usual type of office cuspidor, but inwardly there is sufficient difference to earn the inventor patent rights. At several points about the inside of the cover small hooks are provided. Upon these hooks hang tiny, non-spillable cups filled with a powerful disinfectant. The disinfectant constantly evaporating, completely stifles the usual offensive odor of the cuspidor.





An Electric Floor Polisher

To a Missouri inventor credit is due for a clever floor polisher, operated by electricity, and on which he has been successful in obtaining patent rights. Briefly, the floor polisher consists of an electric motor driving a polishing member through suitable gearing, the entire equipment being mounted on a small truck.

Novel Door Lock

A new type of door lock somewhat different from the thousands that have gone before it, has secured patent rights for a Michigan inventor. The new lock is of the sliding type, and is fundamentally simple in design and operation. Two curved, pivoted arms whose outer ends drop into slots on a bolt, which is screwed to the opposite door jamb, are manipulated by a key, or knob, which turns from the outside. When the door is closed—it must be a door of the sliding type—the two curved rods slip up over the tapering bolt and drop into the slots, and the door is locked.

Shade and Curtain Pole Hanger

The handy-man-about-the-house will appreciate a combined curtain pole and shade hanger which has been devised by an inventor in Pennsylvania to alleviate a considerable portion of his labors. The hooks which support the curtain-pole and the bearing supporting the ends of the shade roller are made in one piece, so that a couple of nails or screws will do for both. The shade roller supports are adjustable. They fit into small grooves with notches along the bottoms, so that by advancing the support forward or backward shortens or lengthens the distance between the roller tips.

Hand Bag and Dress Protector Combined

Amidst the outpouring of new ideas in vanity cases, hand bags and other feminine requisites, comes an invention from a young woman in Philadelphia which is genuinely refreshing. It consists of a hand bag which can be unfolded to form a seat. The two sides of the bag are hinged at the ends, and they are provided with light but strong braces, the purpose of which is to stiffen the folding-in sides of the bag, thereby forming the sides of a seat which will prevent dirt and dust from coming in contact with the dainty dress of the shopper.

A Detachable Handle

A new idea in detachable handles for lifting hot cooking pans with a minimum of trouble and a maximum of safety has been patented by a man in New Jersey. His invention consists of a pair of handles which hold the pan-grasping mechanism in a tight spring. The stiff iron wire around which the top of the pan is rolled is turned downward in the shape of a narrow "U." Members at the end of the handles clutch this U-shaped projection so that a heavy pan can be lifted without difficulty.

Ingenious Cigarette Case

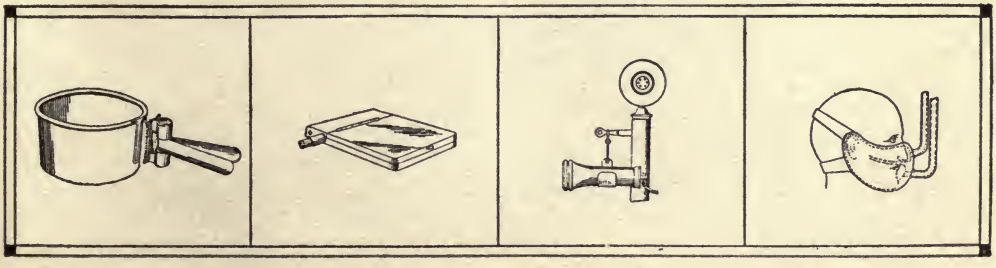
A cigarette case, which ejects one cigarette at a time from an opening in the side of the case, has been patented by a man in Kansas. The cigarettes are placed side by side in the box, held against one side by a spring, and ejected one at a time through a little opening in one side near the end. The cigarettes are fed upward and through this hole almost automatically, the only effort on the part of the user being to press a little thumb plate. An ingenious arrangement of springs does the work.

Fire Alarm on Telephones

To dispense with the ordinary costly and complicated fire alarm system, an inventor in New Jersey has brought out a small device which is intended to be attached to a desk telephone. The telephone receiver is suspended from the hook by a wire and clamp. In the wire is an element which melts in the presence of abnormal heat. This releases the receiver, the hook flies up, warning the central station operator or an operator at a factory or office switchboard that a fire is in progress in the immediate vicinity of the particular telephone.

Breathing Mask for Divers

A compact breathing apparatus for pearl divers and others who do not wish to go to the expense of equipping themselves with the usual costly diver's gear, is the subject of a patent recently issued to an Ohio inventor. A flexible mask stretches from the ears around the mouth and nose. In its fore part two hose connections are provided, one opposite the nose and the other in front of the mouth. Inhaled air passes through the upper tube; exhaled air through the lower.



CHESTNUT POLES REPLACING YELLOW PINE

Extensive experiments have proven that yellow pine poles last about four years, while chestnut poles have a life of about ten years. The city of Brooklyn has recently approved of the plan of replacing the present yellow pine octagonal poles with chestnut poles. The work will soon be under way and the old poles will be sold for kindling. The new poles are to be 25 to 30 feet long and used for the suburban street arc lighting system.

ELECTRIC POWER RUNS ARABIAN PALACE

The first installation of electric lighting equipment in Arabia has just been completed in the palace of the Sultan. N. S. Bayanker, a young electrical engineer of India, persuaded the monarch that electric lights and power were not only safer than the old forms, but a great deal more agreeable. Tungsten lamps now cast their cheery glow in all of the rooms of the palace, while a system of motors is in process of installation for the purpose of swinging the huge fans, or punkahs, as they are called. The young engineer has secured permission to erect and operate a small power plant in Arabia as soon as he can secure the apparatus. There will be two 30 K.W. generators, supplying current for six thousand lamps. One set of machines will be run at night, the other during the day, principally for the purpose of driving the punkah motors. Electric fans have not been received very cordially by the Arabians, although a few have been introduced.

Power will be furnished by oil engines and direct current will be used. High tension lines will never figure prominently in Arabia, as there are no sources of water power to furnish the energy for hydro-electric plants. All the equipment will be of German manufacture. It arrived on the edge of the Arabian desert shortly before the outbreak of the war, and is being transported inland by camel caravan trains.

Another Arabian ruler—the Sultan of Lahej—recently purchased an electric generating set at Cairo, Egypt, with which he will illuminate his palace at Lahej, an Arabian town eighteen miles northwest of Aden. A complete equipment of electric lamps, wires, punkah motors, and ice-freezing machines has also been bought. A young native electrical engineer has been engaged for looking after the plant.

THE PREPARATION OF AN ELECTRICAL ACT IN VAUDEVILLE

(*Continued from page* 240)

and when one has assimilated their entire contents, there is still a good deal to learn on the subject. But every iota of knowledge helps, particularly in the theoretical end, which does not necessarily mean the mathematical end. Probably the less mathematics the practical builder tampers with, the better he will be off, for the actual design of the apparatus has been spared him. What he needs is a good, sound knowledge of the characteristics of the high frequency current, and this may be quite readily obtained from a few good books. With knowledge and a fair equipment of tools, let him start in with what will probably prove to be the most interesting and fascinating work he has ever attempted.

PLANT CULTURE BY HIGH FREQUENCY CURRENT

(*Continued from page* 243)

bed in order that comparisons may be made at frequent intervals. In order to put the experiments on a practical footing, the notes taken during treatment and subsequently should include data on the weight, amount of foliage, percentage of edible portion, quality of the latter, time required to bring plants to maturity, etc. These notes will be useful not only to the individual investigator, but to the world at large.

Questions and Answers

This department will appear regularly in THE WORLD'S ADVANCE, subject to following regulations: The questions must be legibly written with typewriter or in ink, on one side of the sheet. Each question must be definite and cover but one point of the subject under consideration, although a letter can contain more than one question. On the 10th of the second month preceding the date of issue of the magazine all the questions on hand will be considered and those which are put in the most intelligent manner and of widest general interest will be selected for publication in such issue, the number being governed by the space available. All other questions will be returned to the writers with a statement of the price for which they will be answered by letter. Return postage must be enclosed with each letter containing questions, and the letters must be addressed to the Questions and Answers Department and contain nothing relative to other departments of the magazine.

WAVELENGTH.

(7) W. P. R., Cresco, Iowa, asks:

Q. 1.—My aerial consists of eight wires, 140 ft. long and spaced 3 ft. apart. I am greatly bothered from static and am under the impression that the number of wires does not affect the strength of received signals. If I should change my aerial to two wires would I receive just as well and at the same time cut the static down to one-fourth?

A. 1.—The number of wires in the aerial does have an effect on the strength of received signals, but it is in no manner as marked as in the case of transmitting. You would not notice any great difference in the strength of signals by cutting down your aerial to two wires, but by doing so you would gain little in the reduction of interference from static. Better leave the arrangement as it is.

Q. 2.—The wavelength of my aerial is about 300 meters. Could I reduce it to 200 meters? If so, what value of capacity would it be necessary to insert in series?

A. 2.—You could cut it down by inserting a capacity of approximately 0.0002 m.f. This is a heavy photographic plate 6 in. x 8 in. coated to within an inch of the edges with heavy tinfoil.

Q. 3.—What is the formula for calculating the wavelength of a set when additional capacity has been added in series?

A. 3.—If W is the wavelength in meters, L the inductance in centimeters of the aerial circuit, C the original capacity in microfarads of the aerial circuit, and K the added capacity in microfarads, then

$$W=59.6\sqrt{L\left(\frac{CK}{C+K}\right)}$$

Q. 4.—What causes wireless signals to fade?

A. 4.—The throwing out of adjustment of the detector and loose connections are the most prolific causes of fading signals. Other than this, there are the atmospheric conditions which cause both fading and swinging.

REWINDING MAGNETO MACHINE.

(8) B. H., Ithaca, N. Y., asks:

Q. 1.—How can a low-tension Kellogg magneto telephone bell ringer be changed into high-tension motor suitable for operation on battery currents?

A. 1.—Undoubtedly you have just exchanged the use of the high and low-tension statements, for you mean how to turn the relatively high tension—75 volts—alternating-current generator into a low-tension—6 volts—direct-current motor. Dependent upon the room available at the connection end of the armature and your facility with tools, you will have satisfactory results, or otherwise, with the attempt. After removing present wire, draw out the insulated pin and the insulation itself—you will need the full size of the hole for the two commutator wires. Insulate the iron core with "Empire" cloth, taking especial pains to cover the sharp edges that are difficult to keep away from the wire. Perhaps No. 23 would be a good size to use, and, instead of beginning at one end of the wire, estimate about what length will be required, make a loop, and begin at the middle, winding a dozen or twenty turns first with one end, then with the other, the result being that both terminals are outside ones. To these ends solder "fixture" wire, or such other flexible sort as can be led through the hole in the shaft. A disc rather than a cylindrical commutator can be made by use of a fibre washer, say ⅛ in. or more in thickness, on which is fastened by at least four small screws a brass or copper washer about 1 in. in outside diameter, with large enough hole to clear the shaft. A diametrical saw-cut can be then made, separating the washer into two semicircles, and one of the two wires pinched under each. Let the two copper brushes stand up vertically from the wooden base, bent at their contact with the commutator so as to permit rotation in either direction. With the field magnets pulling the "H" armature into its resting position the tips of the brushes should be bridging across the saw-cut.

LIGHTNING PROTECTION.

(9) C. T. P., New York City, asks:

Q. 1.—What kind of a ground connection as a protection against lightning can I have in an apartment house where no space is available for above purpose?

A. 1.—This all depends on the facilities at hand. The Fire Underwriters usually require a No. 4 copper ground running from the point outside of the house where the ground switch is located to disconnect the aerial from the instruments to a good earth or pipe ground outside of the house. Is it impossible for you to drive a 1 in. iron pipe in the ground directly below the point of entrance of your lead-in and to run a No. 4 copper wire to this pipe? If your aerial is not large, the inspector may give you permission to connect your ground wire to a radiator inside of the house. This method has been used where there is a radiator in the room near the lead-in, and it has been found to work satisfactorily, although it must by necessity add an element of danger if the ground wire runs in an exposed position or for any considerable distance within the house.

Q. 2.—What detector is known to be the most sensitive at the present time?

A. 2.—The audion in some of its more complex forms is unquestionably the most sensitive detector yet known. By using three audions very extensive amplifications are obtained.

STORAGE BATTERIES.

(10) A. J. M., Wausaukee, Wis., asks:

Q. 1.—How to connect a storage battery with the magneto generator on a Ford automobile?

A. 1.—A storage battery requires a direct current, and, since the Ford generator gives alternating currents, the project is impossible. You will have to substitute or add a direct-current magneto. A number of firms are making specialties for Ford cars, and it might be worth your while to address the Gray & Davis Co., Amesbury, Mass., or some of their agents, or the General Electric Co., at their Milwaukee office, in the Public Service Building. Electric auto-starters, involving a motor and storage batteries, are offered that will exactly fit the space available, and give a very satisfactory equipment, the expense being $75.

INDUCTION MOTOR PROBLEM.

(11) M. E. P., Wrangell, Alaska, asks:

Q. 1.—What is likely to be the reason that an induction motor modified from an old direct-current Westinghouse fan motor will not operate? A new 20-slot laminated stator was made, and the original armature was fitted with eleven No. 4 copper wires, soldered, though imperfectly, to copper end-rings.

A. 1.—The use of 20 slots is permissible, though in keeping with the number required for the running coils of Watson's motor, to which you referred, you would have had but 16. You did not state how the winding was arranged, but it should be as follows: A coil filling slots 3 and 4; a concentric coil in series with this filling slots 2 and 5; a coil concentric with these and occupying only one-half of slots 1 and 6. This group would constitute the winding for one of the four poles. Similarly, there will be full coils in slots 8 and 9, 7 and 10, and a half coil in 6 and 11; a third group will be in slots 13-14, 12-15 and 11-16, the fourth in 18-19, 17-20 and 16-1. As the inner coils embrace very little iron, it would have been an improvement to have had the four central teeth larger. You should rebuild the rotor, using copper rods long enough to extend through holes drilled in the end rings, then head them over and solder-sweat them in position.

AERIAL.

(12) C. W. S., Modesto, Cal., asks:

Q. 1.—Would you consider an aerial for wireless work well proportioned with the following dimensions: 125 feet long, with a height of 100 feet at one end and 50 feet at the other end, consisting of eight stranded wires 30 inches apart?

A. 1.—Yes, it would be satisfactory but would have a wavelength of greater than 200 meters.

Q. 2.—How would you split this aerial in order to use two leads so as to send or transmit on part of it without exceeding the 200-meter limit and yet do efficient work?

A. 2.—Any method of trying to split it will prove unsatisfactory. If you desire to use this aerial use as short a lead-in as possible and put a condenser in series. This will not be as efficient as having an aerial of the correct proportions to start with.

THE DISCOVERY OF GUNPOWDER.

(13) H. S. S., Cedar Rapids, Neb., asks:

Q. 1.—Was gunpowder discovered or invented?

A. 1.—That a mixture of sulphur, charcoal and salt-peter would unite with explosive force was certainly a discovery, and even the determination of just what proportions of the chemicals to use, in what forms, etc., would also properly be termed discoveries, but processes for manufacturing the article might be termed inventions. Discoveries are not patentable, but a manufactured article or invention, resulting from discovery, is patentable. Certain processes for making gunpowder, perhaps the only ones for particular kinds, may be patented.

No questions will be answered by mail unless they are accompanied by the fee of fifty cents. This fee is charged to partly defray the time involved in answering inquiries.

RADIO SECTION

Devoted to the Encouragement of Amateurs and Experimenters in the Field of Radio Communication.

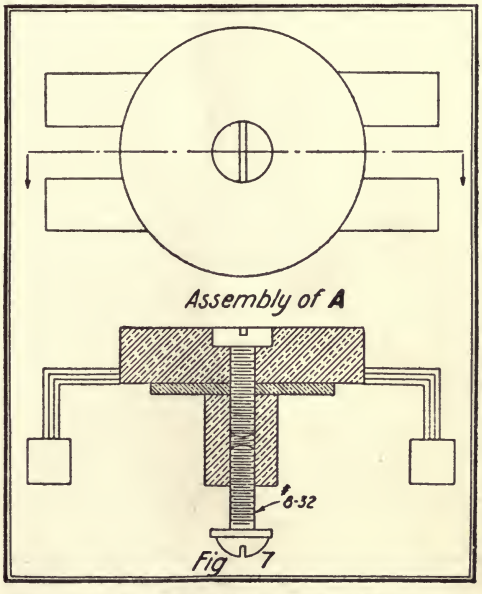
A Multiple Receiving Tuner*

By Chas. P. Seeger

AFTER having accomplished the work outlined in the first portion of this article, the reader is prepared to pursue the task as follows:

DETECTORS: In the first detector to be described the pillar is a piece of ½" brass rod cut to the dimensions indicated, the springs being inserted on either side of the central piece. The retaining bolt should be made by drilling a hole in a piece of ½" rod and "sweating in" a piece of 5/32" rod, threaded at the end to receive an 8-32 hexagonal nut. A similar but shorter retaining bolt is used in the free end of the detector. Before cutting the rod into the desired lengths for the pillars, it is suggested that a 3" piece be taken to a machine shop in order that the 5/32" hole necessary to receive the retaining bolt may be drilled through the *center,* otherwise it will be difficult to assemble the parts into a neat appearing unit.

Instead of the designated contact point, sharp pointed 8-32 fillister head machine screws may be used, either of iron or brass, depending on the crystal in use. For the springs use 18 or 20 gauge springy stock, cutting to the desired length. Cups for the detector may be purchased or made by soldering a plug in a piece of ⅜" tubing and fastening a pivot to the plug. A base may be made of ½" round rod, 3/16" thick, soldering a piece of 5/32" brass rod, threaded 8-32,



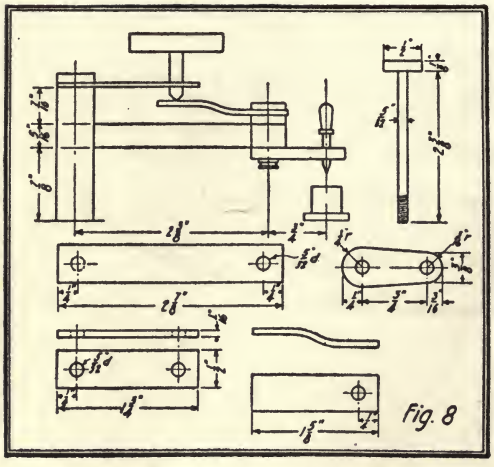
Details of One of the Switches.

to one side, and drilling the other to fit the pivot.

The second detector is truly a universal detector, for one in use at the present has been converted into the well-known cat-whisker type, by interchanging the cup and the clamping screw, and fastening a wire to the movable arm.

Obtain a piece of tubing ¼" outside

*Continued from the July issue of THE WORLD'S ADVANCE.



Various Parts of the Mineral Detector.

and 3/16″ inside diameter. Into one end solder or "sweat in" a piece of tubing ⅛″ inside diameter. It will probably be necessary to sandpaper the outside of this latter tube to a considerable extent, as the nearest sized tubing manufactured is somewhat larger than 3/16″ outside diameter. Drill the standard as indicated for a ¼″ hole, and after sandpapering the tube, and the standard as well, ready for finishing, drive the tube into position. Then drill and tap a piece of 3/16″ rod for a 4-36 thread, and screw into this a piece of threaded ⅛″ rod, about 2″ long. Obtain a spring to fit over the ⅛″ rod and fit the parts together as indicated. Purchase or turn a rubber handle—a disc may be used—and fasten to the ⅛″ rod by drilling and threading for a 4-36 thread. A forced fit, using a drill slightly smaller than the rod, will frequently give good results.

It will probably be found easier to purchase the cup and fit it to a 3/16″ rod than to turn it up. A piece of 3/16″ rod should be soldered, or fastened by threading, to the cup.

Drill 3/16″ holes in the standard bases, and solder in 3/16″ rod, threaded at the other ends for a 10-24 thread. Drill through the lower part of the movable standard, fitting the rod to the lower part, the upper part serving as a socket for the pivot. These standard pieces should be squared up with considerable care, the centers for the holes also being located carefully.

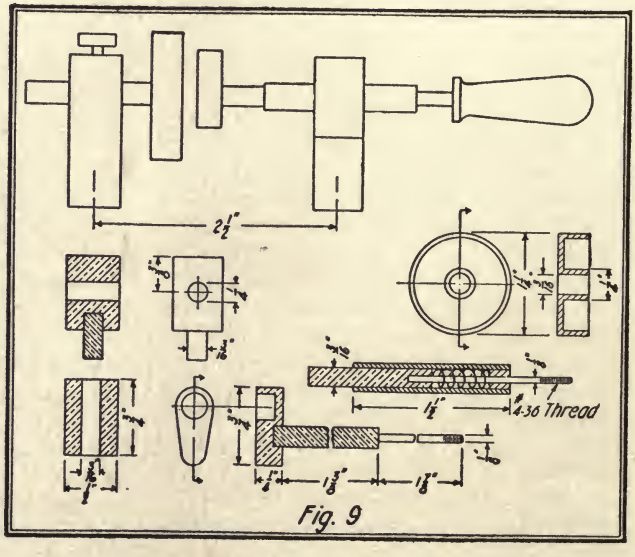
Additional Details: Besides the four handles for the switches, one should be turned up to the size indicated in *E*, Fig. 6, as a handle for the coupler axis.

Turn up three rings to the size indicated in Fig. 1, 2⅛″ O. D. and 1⅝″ I. D., and from ⅝″ to ¾″ thick. The rings should preferably be of black fibre, though stained wood will serve the same purpose.

In case the telephone key is not used, it will be necessary to use the Type *D*, a three pole Keystone rubber base switch, as indicated, as well as a double-pole double-throw switch, placed not on the box but conveniently near it.

ASSEMBLY.

If the box was not made with the top and sides hinged to the bottom—the top being glued to the sides—it will be necessary to fasten the interior apparatus to the bottom instead of the top. How-



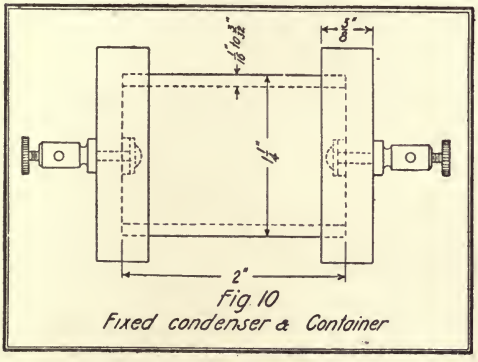
Details of a Perikon Type Detector.

ever, the hinging is suggested as it not only affords accessibility, but also simplifies the connecting of the instruments.

Fasten the first primary to the bottom of the box—or the top as the case may be—by means of small tacks, or a thin brass strip. Support the second by thin brass clips as illustrated in Fig. 11. *The couplers must be mounted as illustrated with their planes at right angles to each other,* in order that no mutual inductance may exist between them.

Slip a 3/16" rod 16" long, threaded 10-24 for 12" of its length, through the primaries and secondaries as indicated, fastening the secondaries in position with lock nuts at right angles to each other. One end of the box serves as one support and bearing for this rod. At the other any convenient form of support may be arranged. The handle should be graduated for one-quarter of its circumference into eight equal divisions in order that the coupling may be readily set to any degree. It is unnecessary to move the secondaries through a greater angle than 90°, and if this is exceeded, connections are liable to be disturbed.

Fasten the loading coil to the con-

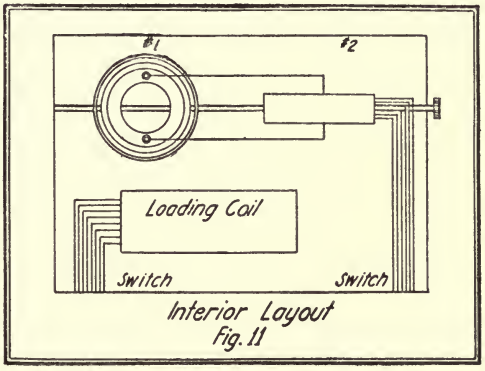


The Case of the Fixed Condenser.

tainer box with two brass strips, or by turning up wooden standards for it.

Before mounting the switches, make a full-sized drawing of the top and sides on paper, laying out the positions of contact points and switch centers on the paper. Then place the paper on the box, and indicate all holes by light punch marks through the paper. This prevents unnecessary scarring-up of the box.

The circles indicated for the switches are the circles on which the contact centers are placed. The contacts are ¾" apart, measuring from center to center, and are placed as indicated in the connection diagram. The *A* switches have



Arrangement of Loose Couplers and Loading Coil.

four points per side, while type *B* is an eight-point switch with its contacts spaced ½" apart, center to center. The telephone switch, if used should be placed between the *B* and *C* switches.

No attempt has been made to describe the construction of the three variable condensers, which should be of the rotary plate type. Should the reader desire to make them, he is referred to an excellent description in *Electrician and Mechanic* for October, 1912, or the plates may be purchased from the makers of variable condensers. Condensers Nos. 1 and 2 should be filled with castor oil to the level of the top plates. The condenser in the detector circuit is kept at the original capacity. The condenser in the intermediate circuit should have a thin copper strip fastened to the stationary plates so that the condenser is short-circuited when turned past zero.

The small fixed condenser consists of eight strips of foil, measuring 6" x 1", placed between paraffined paper measuring 6" x 1½"; the foil projecting at opposite ends. It should be rolled up and slipped within the tube prepared for it, the terminal being connected to the binding posts which slip on studs projecting from the box. (See Fig. 10.) C_5 is in the audion box.

While connecting wires may be strung

at random within the box interior, it is suggested that bare wire encased in thin rubber tubing be used, the wires thus insulated, being fastened to the box in a pre-arranged manner by means of small escutcheon pins.

This set will perhaps furnish a little difficulty, as regards facility of operation, when used for the first few times.*

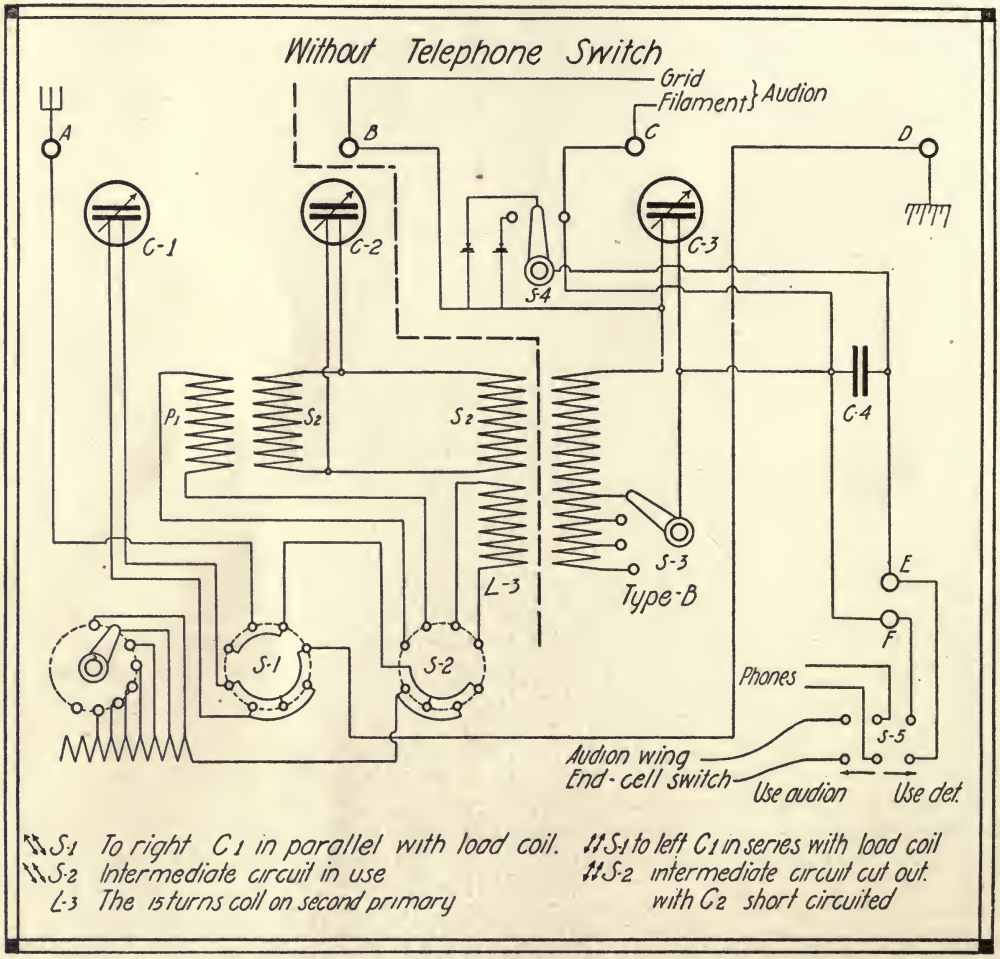
"No matter what coupling may be used, the set is always tuned to two wave lengths. Provided all other adjustments of the set remain fixed, increasing the coupling causes an increasing difference between the two waves to which the set is tuned, one a long, the other a short wave.

"Assume that the original setting is coupling K_1, and condenser capacity C_1 (No. 1 condenser) the set being tuned at 1200 metres and 200 metres. Then assuming that it is desired to receive from a 1200 metre station, and eliminate one at 200 metres, the process of tuning out is as follows:

"1. Increase the condenser capacity C_1 to a new value C_2, so that the 1200 metre station is lost for a moment, and the 200 metre station has become very faint or is also cut out.

"2. Loosen the coupling until a point is reached where the 1200 metre station is again heard, but at this new coupling, the 200 metre station is entirely cut out."*

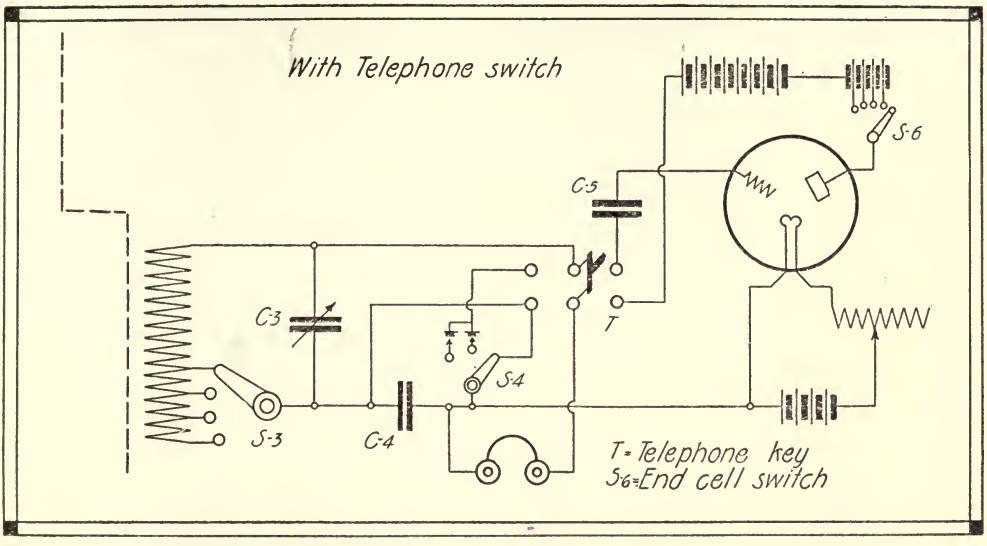
Arlington may be heard by turning S_1



Wiring Diagram for Complete Receiving Set Without the Telephone Switch.

*See *London Electrician*, July 19, 1912, p. 623, and *Electrician & Mechanic*, September, 1911.

*Quoted from a lecture by Mr. A. S. Blatterman at the Washington University, 1914, on the Marconi multiple tuner.



Wiring Diagram of Complete Receiving Set, with Telephone Switch.

to the right, S_2 to the left, and short-circuiting condenser No. 2. This procedure enables the reception of very long waves.

The two connection diagrams follow, depending on whether or not the telephone key is used. Binding posts *B* and *C* and *E* and *F* may still be used in the second diagram. S_3 in the first diagram is an ordinary double-pole double-throw switch, *not* placed on the box of the receiving set.

AMATEUR MARCONI RADIO ASSOCIATION

There has recently been formed at Troy, N. Y., the Amateur Marconi Radio Association, which now has a membership of nearly thirty. The association has for its object the bringing of amateurs into closer touch with each other. The club takes in a radius of about five miles with Troy as the center.

The officers of the association are as follows: President, Wendell King; Vice-President, William Robbins; Secretary, Harold Connor and Treasurer, Everett Barnes.

Each member owns a wireless receiving set, capable of receiving the time signals from the Government station at Arlington, as well as those from the Sayville station. The association has recently purchased a hot wire meter for its use in order to enable closer tuning of the sending sets of the more advanced members.

Correspondence with other similar organizations and with amateurs desirous of joining the association is solicited. All communications should be addressed to the Secretary, 827 Third Avenue, No., Troy, N. Y.

ERRATA

The article entitled "A Memorial Fountain to Wireless Operators," which appeared in the July issue, gave the death of Wireless Operator George C. Eccles of the steamship *Ohio* as August 26, 1912. The correct date is August 26, 1909.

A Wireless Direction Finder

By J. Andrew White

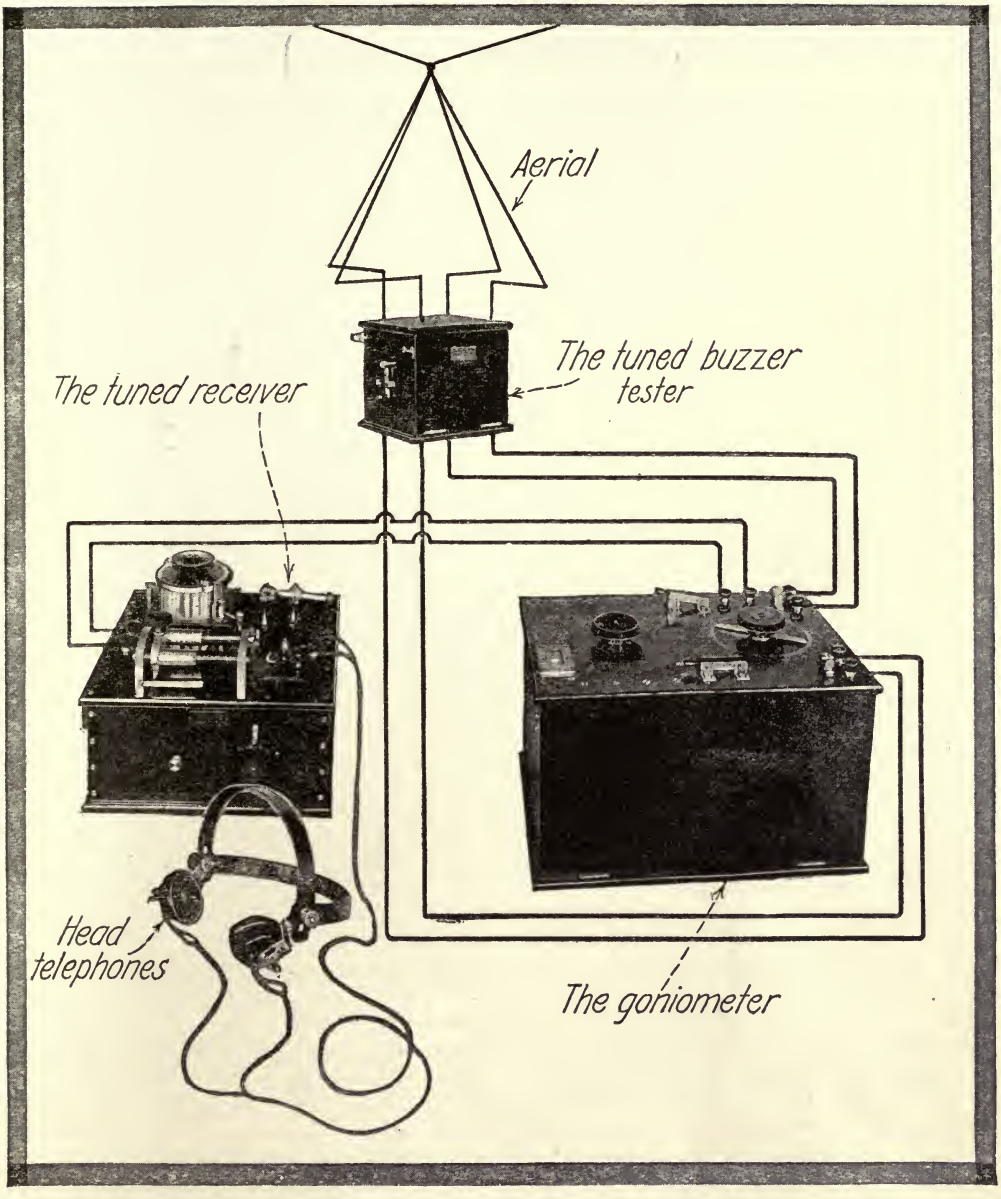
WITH its primary object to enable a ship's navigating officer to take bearings in fog or under unfavorable weather conditions, the development of the radio-goniometer, or wireless direction finder, has disclosed many applications on land and sea, in peaceful quarters and in the center of hostilities. It is reported by an engineer recently returned to this country that the British are employing this new instrument for scouting purposes, and on one occasion secured the position of the Admiral's flagship of the "hidden" German fleet. Its aid as protector of ships and human life was still more recently demonstrated by the captain of a Norwegian merchant vessel in the presence of officers of the Royal Norwegian Navy, an army engineer and two telegraph and radio inspectors.

The experiments were conducted with naval vessels off the Norway coast and the report of the trials as rendered by Captain L. C. Hjortdahl stated that the signals were good even at a distance of 130 miles and were heard at 240 miles. At a distance of 34 miles bearings taken through the Flekkero wireless station corresponded exactly with the ship's position and a series of bearings secured with the direction finder in a voyage between Christiania and Bergen disclosed the positions of various warships scattered along the coast. In the port of Bergen tests were made with a warship lying but one-third of a mile away, proving that it is possible with this new instrument of science to take the position of other steamers in foggy and thick weather even at short distances, and thus avoid collisions.

In the absence of definite reports from the British military and naval forces, which will of course not be available until the end of the war, the details of the investigations pursued by Captain Hjortdahl stand as the only complete record of what may be expected of the newest device to insure safety at sea. Meanwhile government inspectors are experimenting on land to determine the usefulness of the apparatus in detecting the whereabouts of interfering amateur wireless stations, and commercial operators are finding a new effectiveness in "screening out" messages not wanted when working in crowded waters.

Since the earliest days of wireless telegraphy the problem of determining with an instrument the direction from which radio signals arrived has engaged the attention of inventors. Ten years ago Marconi began the preliminary investigations that bore fruit two years later in an apparatus evolved and patented by two of his countrymen, Dr. Ettore Bellini and Captain Tosi of the Royal Italian Navy; the device as developed was not adapted to ship working, however, and the intervening years were devoted to perfecting an equipment entirely satisfactory for use by navigators. The apparatus in use today permits bearings to be taken within two or three degrees of accuracy and is technically known as the Marconi-Bellini-Tosi radio-goniometer. It is not claimed for the invention that the bearings taken by this means exceed, or even equal, in accuracy those secured by the optical instruments of navigators, but the utility of the instrument is found in obtaining reliable bearings when direct readings cannot be taken because of unfavorable weather conditions. It is not necessary to swing the ship to secure a reckoning, and the range of the instrument exceeds the distances required in practical working, being largely governed by the power of the wireless station from which the signals are being received.

The complete equipment consists of the goniometer, a tuned wireless telegraph receiver, a tuned buzzer tester, an angle divider and a special arrangement of aerial wires. Apart from the ordinary aerial or antenna swung between the



Arrangement of the Different Pieces of Apparatus, as Well as the Wiring Scheme for a Direction Finder Receiving Set.

masts, a ship operating the direction finder is required to have two closed circuit loops in the form of triangles of equal size, suspended vertically and crossing each other at right angles. These are usually suspended from a fore and aft stay, or from a sprit, gaff or bracket on one of the masts. Connection to the instruments is made from the centers of the horizontal base wires, this distance being kept as short as practicable and governed largely by the wave length of the wireless apparatus. The wires lead directly into the radio-goniometer case and the received electric energy flows through two excitation coils, setting up a magnetic field which acts upon a third coil known as the exploring coil.

This movable exploring coil is attached to a handle which carries a pointer moving over a graduated 360-degree scale on which the reading of direction is taken. The exploring coil is connected to the wireless receiver and the direction of the arriving wave or signal is indicated by turning the index handle until the position of maximum strength of signals is found. With the goniometer placed so that the zero position of the scale coincides with the bow and stern line of the vessel, the position of the pointer when the signals are strongest in the head telephones of the operator shows the direction of the signals in reference to the bow and stern line. The geographical direction is then secured by a glance at the ship's compass. If for any reason the signals have about equal strength over a considerable portion of the scale, note is made of the pointer's position when the signals die out, and with the angle divider furnished with the set a mean of the two readings is taken.

The action of the received energy on the aerial is interesting and is really the keynote of the operation of the apparatus. Each triangular loop is a directional aerial in the wireless telegraph sense of the term, receiving best when its plane is in the direction of the sending station. When either of the aerials is at right angles to the direction of the incoming signals nothing is heard; in intermediate positions the induced current varies with the angle and is set up in both aerials. Carried to the goniometer, or direction finding instrument, current of the same relative strength passes through the corresponding crossed coils and forms in the space enclosed by them two magnetic fields at right angles to each other. These two fields combine and form a field at right angles to the direction from which the signals are coming. The exploring coil thus receives the signals strongest when its plane is at right angles to this field, or in the direction of the signals, the pointer mounted on its spindle indicating this position on the dial.

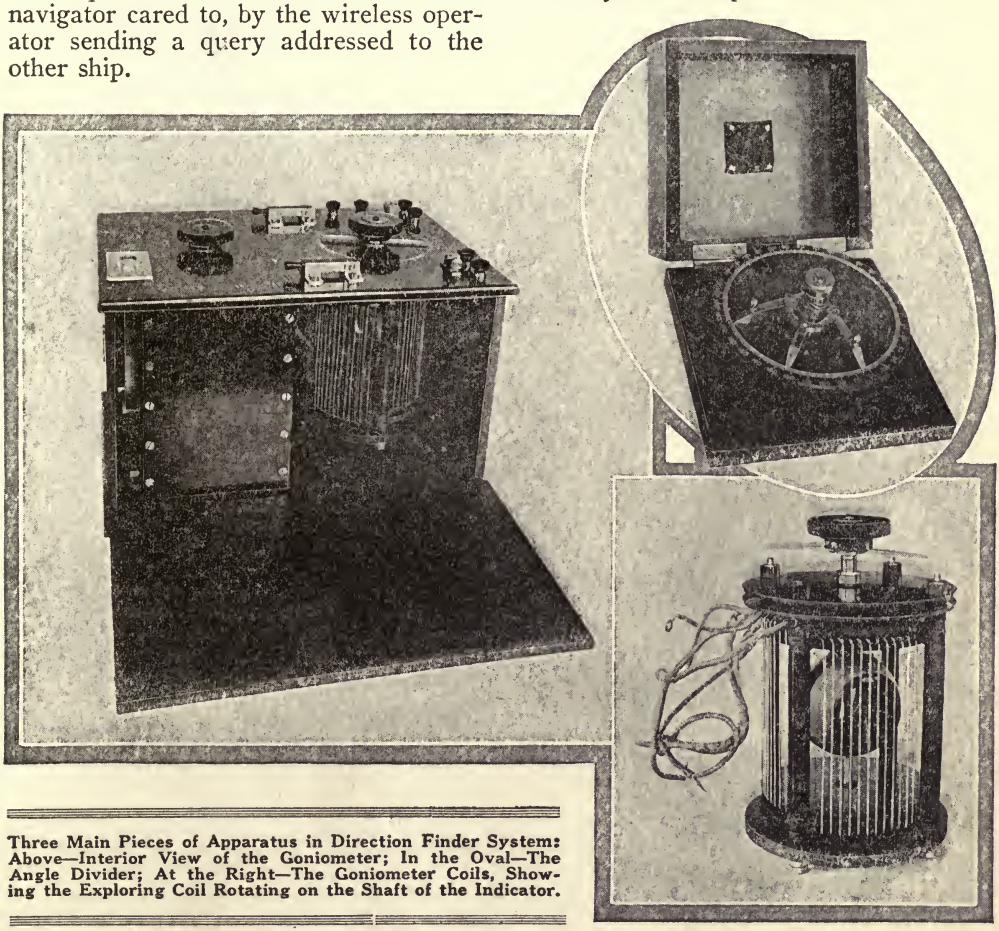
An oscillatory circuit composed of a condenser and a coil of wire is used for testing, the instrument being adjusted to the desired wave length by means of a switch. The wires connecting with the aerial are taken past the coil at equal distances, so that the two aerials are equally excited. The buzzer is of the type in which a non-inductive shunt is connected across the magnet coils, sparking at the contacts being thus reduced and a sudden interruption obtained.

When the direction of the wireless station sending is indicated by the pointer, only the line on which it lies is given. That is, it may indicate a direction thirty degrees off the course of the vessel, but it does not distinguish whether this is off the port bow or its diametric opposite, the starboard quarter. If the test is being made with a land station there is seldom any doubt of the direction, as it is generally known whether the land lies to the port or starboard side of the vessel. And whether the ship is approaching or receding from the land station is at once obvious; in most cases there is only one possible interpretation of the indication, for by the reverse interpretation the ship would be somewhere inland and the land station out to sea. Two successive readings while the ship is on a fixed course place the matter beyond doubt and at the same time give the distance to the station by the usual nautical method. By taking simultaneous bearings of two fixed stations the ship's position is easily reckoned. Or a reading taken with a single fixed station and a second observation made after the ship has moved forward a definite distance in a straight course establishes the position equally well.

One of the things which the navigator may learn through the wireless direction finder is whether the ship is on a course which will take him inside or outside a lightship. The captains of many vessels on the Atlantic lay their course for the Nantucket lightship and after they have made this isolated beacon trace their course to another point. Often they run inside the lightship and miss sighting the vessel. A few signals from the wireless equipment aboard her will secure the location as certainly as if the light were visible.

When making a harbor a few signals from the land wireless station show immediately whether the ship has drifted to one side of the entrance.

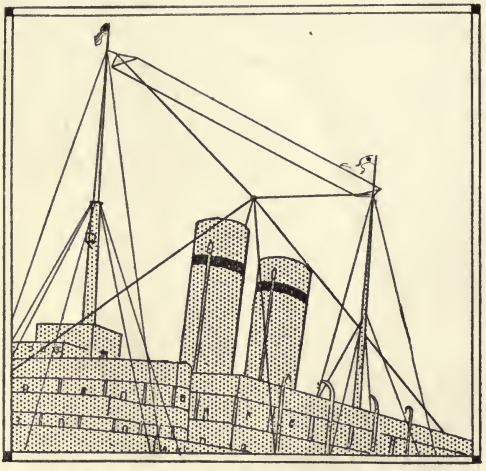
Collisions in fog may also be avoided through ascertaining the presence of another vessel by a regularly repeated signal. The direction determined, the increasing strength of the signals would indicate that the other ship was approaching and the course could be slightly altered to avoid her. Any question as to whether the ship was approaching on the port bow or overhauling on the starboard quarter could be determined if the navigator cared to, by the wireless operator sending a query addressed to the other ship.



Three Main Pieces of Apparatus in Direction Finder System: Above—Interior View of the Goniometer; In the Oval—The Angle Divider; At the Right—The Goniometer Coils, Showing the Exploring Coil Rotating on the Shaft of the Indicator.

In the avoidance of collisions at sea the direction finder has a field of incalculable value. So also in rescue work is it of the greatest assistance. It will be remembered that when the heavily laden steamship *Monroe* received her death blow off the Virginia coast she sank so quickly that there was no time for the wireless operator to send out the ship's position. In such emergencies the distress call alone would be sufficient for the direction finder to give to the captain of the rescuing vessel the direction to take through the thickest blanket of fog. Once turned in the direction given by the pointer a straight course would bring the relief vessel to the scene of the disaster in the shortest possible time. What a few minutes lost in blindly groping through the fog means is best appreciated by a mental picture of hundreds of struggling humans striving to keep afloat in the icy waters of midwinter.

The accuracy of the instrument is surprising in view of the fact that Marconi claims for it a possible error in taking bearings of two to three degrees, and under the most unfavorable conditions not in excess of five degrees. Tests made along the Atlantic on the steamship *Northland* checked absolutely with the



The Usual Aerial and the Direction Finder Aerial on Board Ship.

captain's compass and chart reckoning and resulted in the United States Navy and the revenue cutter service installing the equipment on some of their vessels. The exhaustive investigations yet pursued, however, are those made from the Norske Amerika liner *Kristianiafjord* and mentioned earlier in the article. In the report presented by her captain, L. C. Hjortdahl, it is stated that distances of 90 to 130 miles were obtained and bearings were taken very quickly. There were present besides the wireless men and government telegraph experts, Captain Gootwaldt, of the Royal Norwegian Navy, and Engineer Skolem of the army, the investigation being an official one of the little country that ranks fourth in tonnage among the maritime nations of the world. For this reason the report is of significance beyond its value as the first record made of an instrument probably destined to become an important factor in safety of life at sea.

A translation of the substance of the report follows:

The *Kristianiafjord* left Christiania on March 21, at 9 a. m. During the passage out of the Fjord wireless communication was steadily maintained with the land station at Ovresaeters, a one-half kilowatt temporary military installation.

At Filtvedt bearing was taken from the Navy Yard station at Horten by the direction finder until we had the station abeam. The bearing was checked with the one taken from the bridge and found correct. The communication with Ovresaeters was lost fifty miles off —when we passed Fuflehuk.

We were keeping steady bearing with the Tjomo station while we were going out of the Fjord past the Faerder lighthouse, and results very good. At 5:30 p. m. bearing was taken with the Flekkero station at a distance of thirty-four miles. The bearing corresponded exactly with the ship's position. At the same time bearing was taken of the naval station at Horten, ninety miles off. The discrepancy in this bearing appeared to be one and one-half degrees and two miles off the ship's actual position.

At 6:20 p. m. bearing was taken with Flekkero at a distance of twenty miles. The discrepancy of the angle was about one-half degree. At 7 p. m. we again took bearing with the Tjomo station, ninety miles off, the discrepancy in the angle being one degree, and referring to the ship's position, 1.6 miles.

At the inlet to Christianssand, at 8 p. m., bearing was taken with Flekkero and this corresponded; the same good results were observed when we passed out from Christianssand again at 9:45 p. m. During the voyage westward we found by the direction finder the correct position of different Norwegian warships scattered along the coast.

At midnight we took bearing with a Norwegian torpedo boat destroyer, which we then called up by wireless and checked the position; it was one degree off. At 1 a. m. bearing was taken with a Norwegian cruiser and from communication learned that the distance was 38 miles and the discrepancy of the bearing two degrees.

At 2:45 a. m. bearing was taken with the same warship, twelve miles off; the fault was three degrees. At 5:30 a. m. and the distance seventeen miles, the fault was one and one-half degrees.

At 6:30 a. m. bearing was taken with a gunboat lying at Haugesund, thirty-one miles away; the discrepancy was one degree. At Stavanger at 10:45 a. m., the same ship was thirty and one-half miles away and the fault was two degrees. At 4 p. m. bearing was taken with the same ship repeatedly, the faults being on an average of one degree.

During the voyage from Stavanger to Bergen, on the same evening, bearings were taken with a Norwegian cruiser and a torpedo boat destroyer stationed in these waters. These bearings showed a constant fault in a southerly direction of six-eighths of one degree, and it is believed that this fault was due to local conditions of the district. During the trials later made with the Bergen station and a Norwegian warship lying in that port, the results varied between one and four degrees from the ship's actual position. The distance to Bergen and the warship ranged between fifty and sixty-two miles.

While lying in the port of Bergen tests were made with the same warship, anchored only 600 meters from the *Kristianiafjord,* and the results were exact. This should prove that it is possible with the direction finder to take the exact position of other steamers in foggy and thick weather even at short distances.

During the afternoon of the 21st, bearings

were taken repeatedly with the station at Gothenberg, in Sweden, and faults of from eight to ten degrees were always found. These discrepancies were always in the northern direction. As no such deviation was found during the tests with other wireless stations this is apparently due to some fault. The Telegraph Department will investigate whether the regular wireless communication from Gothenberg in this direction shows variations. The signals from Gothenberg were very good even at a distance of 130 miles, and in the evening of the 22nd, Gothenberg was heard at a distance of 240 miles.

Conclusions:

Although it has only been tested during a short voyage, the impressions of the instrument are that if reckoned with about a three degree discrepancy in the bearings we have here an excellent aid to safe navigation. The manipulation of the apparatus is very easy and with a little experience bearings can be taken very quickly.

(Signed) L. C. HJORTDAHL.

FREAKS OF THE ETHER

"SINGING static" is probably a new term to many of those interested in electrical phenomena, but it is a condition that is often met with in the tropics, or any heavily charged electrical area. "Static," as most of those who have handled wireless receiving sets know, is a succession of electrical discharges passing from the aerial to the ground, and, as a rule, of a scratchy, rasping note, irregular in character, and generally more prevalent during hot, dry winds. "Singing static" differs in that the note is steady, often of high musical pitch, varying from a note similar to that emitted by a 240-cycle generator to that of 500 cycles and over. Unlike ordinary static, it is ofttimes capable of being sharply tuned, from what observations the writer has made, being on an average of 1,000 meters. It is noted most during a rain squall in hot, humid weather, and at times the discharge will be heavy enough to cross an anchor gap or ground plate, accompanied by its characteristic note.

During hot, dry weather a blast from the whistle of a steamship will induce a rough note in the wireless set, and at times a stream of sparks across the anchor gap. This phenomenon is less noted during fog, but at times when the whistle is being blown frequently it will interfere with the reception of messages.

While off the Delaware breakwater during the month of August, the writer had occasion to note a static phenomenon that is not often met with. There had been several thunder showers and the weather was humid. The aerial clip had been detached from the helix and was hanging free without connection to the ground. Immediately after a squall, a high whining note was heard in the wireless cabin, coming apparently from nowhere. Approaching the helix clip, this note rose higher than before, and a small brush of flame played around the clip. With the receding of the body, the note died down, to rise again with the approach. Moving the hand rapidly back and forth from the clip caused the note to rise and fall with the motion of the hand. With the hand three inches or so from the clip, a shock was felt. Using a long insulator, the helix clip was brought close to a deadlight curtain rod fastened to the wall and insulated from any conductor. At two inches a bright brush discharge was obtained, accompanied by a high note, and holding the helix clip at three to four inches the discharge changed to a succession of sparks, with a resultant broken note. Leyden jars were charged, and bringing the head of a person within six inches of the clip caused the hair to stand on end in ludicrous fashion. The discharges continued for an hour, slowly dying in pitch and volume, until only an occasional spark could be drawn. Following the ceasing of the discharges, lightning began playing on the horizon. Each flash of lightning was followed by a heavy discharge across the ground plate. It is interesting to note that where the lightning flashes could be seen from the deadlight port, that the flash and the crash of flame

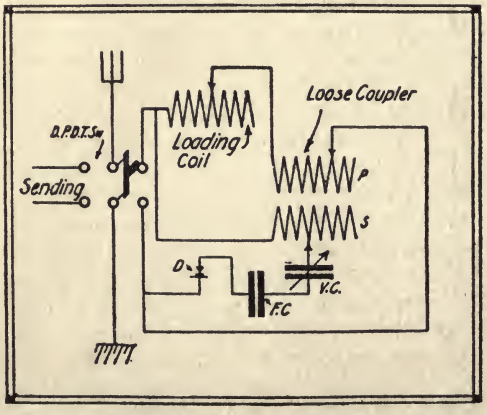
across the ground plate seemed simultaneous, the resultant thunder accompanying the lightning was heard from one to three seconds later.

The last sentence recalls an instance which serves to show the wide difference between the rate of travel of ether waves and those of sound. At San Pedro, Cal., many of the ships entering that port dock within a few hundred feet of the wireless station at that point. The power, 5 K.W., is sufficient to send a discharge across the anchor gaps on the sets aboard the larger ships, the character of the note reproduced in the ship station when the operator was sending in the shore station enabling a message to be read without the use of the 'phones. On calm days the spark could likewise be heard with the naked ear by an operator standing in the doorway of the wireless cabin. When the operator had finished sending, the finish signal could be seen, heard and read across the anchor gap, and, following that, would come the sound wave, tardily straggling along, considerably later than the electrical discharge.

Aboard the *S. S. Pleiades,* en route from Balboa to San Francisco, lightning struck the foremast of the ship, forking from there to the aerial. The shock of the bolt was felt over the entire ship. The current, choked by the aerial loading inductance in its course to the ground, struck off at an angle to an iron beam two feet from the helix. The helix was completely shattered, the two end pieces being split in a dozen sections and the cross beams, held in place by wooden pins, twisted and pulled out. The receiving tuner, separated only by a small single throw switch, was unharmed. All the wheel house and lifeboat compasses aboard ship were reversed, with no two registering alike, and considerable trouble was occasioned in holding the ship to her course the rest of the trip. Steel plates and parts of the ship were magnetized, and when the compass adjuster was called to adjust the compasses, he had more than the usual amount of trouble in so doing.—PAUL OARD.

NEW HOOKUP FOR LOOSE COUPLER

Without offering any explanation of the principles upon which his diagram is based, the contributor submits the accompanying hookup for a receiving set comprising a loading coil, loose coupler, variable and fixed condensers and detector. He claims very good results with the method of connection shown in the diagram, whereas with the conventional form of hookup his receiving radius was small.



An Unusual Hookup Scheme for a Loose Coupler Receiving Set, which Gives Excellent Results.

While the precise reason for improvement is not clear, still the experiments of this contributor might well be imitated with a view to developing any possible merit the new diagram might possess.—FRANK GAMMON.

AN INVITATION TO WIRELESS ORGANIZATIONS

Wireless clubs are requested to communicate regularly with the Editor of THE WORLD'S ADVANCE, stating the activities of the club, which will be brought to the attention of readers. Notices of the formation of new clubs are published when received. Especially are the proceedings and discussions of wireless organizations solicited for the benefit of other similar clubs.

Long Distance Wireless Telegraphy*

By J. B. Woolsey

PREVIOUS to the outbreak of European hostilities, the station at Sayville was engaged in a series of experiments with the Telefunken station at Nauen, in Germany. The Sayville station has since been engaged in the receipt of commercial and official war bulletins from this point, at irregular intervals. The Nauen station (POZ) operates on a wave length of about 9,500 meters and makes use of the so-called Count Arco step-up transformer system for the generation of undamped oscillations.

This system is of interest because the alternations of a generator having an initial frequency of about 20,000 cycles per second are raised to double or triple this value by means of ingeniously constructed step-up transformers, each one of which doubles the frequency supplied to its primary winding. The cores of these transformers are magnetized by direct current flowing through a special winding and are thus saturated to a certain critical degree. When in this state of magnetization, alternating current is passed through another winding (which is the primary winding), causing a change of the existing flux that has been produced by the D. C. winding. Thus a single alternation of current will cause a weakening and strengthening of the existing flux, which in turn produces two alternations in the third winding for every impulse in the primary winding. Thus the frequency is doubled and may be doubled again by the addition of a similar transformer.

The signals from this station are received at Sayville on a special form of Lieben and Reisz current relay which in reality is a type of the gaseous valve detector. This relay is fitted with local fixtures, making it a generator of undamped oscillations which in turn produces the phenomenon of beats from the incoming signals causing an audible note. The Lieben and Reisz relay is, in fact, a copy of the well-known audion.

The Sayville station employs a 500-cycle quenched spark transmitter of 35 K. W. capacity and cannot send to the Nauen station in the daytime. The operators are therefore required to reply to Nauen's communications during the more favorable hours at night time. The Sayville station employs for this work a wave length of about 4,800 meters.

Provided static conditions are not severe Nauen's signals can be read throughout the day at Sayville, but the reception of signals at Sayville is not constant. The station is therefore requested many times to make repetitions.

The traffic sent to Nauen from Sayville is repeated three times to insure accurate reception. This route to Germany is limited in the amount of traffic that may be handled, but nevertheless it is of considerable aid to the Germans while they are cut off from cable communication.

The amateur experimenter who believes that the Arlington station at Radio, Va., is silent during the day may be surprised when he finds that this station is at that very moment apt to be in communication with the naval station at Point Loma, California. These naval stations are fitted with the Poulsen arc type of transmitter having a capacity of 30 or 40 K. W. The receiving apparatus employed for this work is a special form of audion which is particularly suited to the reception of undamped oscillations.

Communication via this route is quite reliable by day and night, a fair amount of official business being dispatched in both directions.

The Arlington station also communicates by means of undamped oscillations with other naval stations which are fitted with receivers for the reception of undamped energy.

A large naval station is about to be opened up at Darien on the Isthmus of Panama. This station is expected to employ a wave length of nearly 20,000

*This is the second portion of Mr. Woolsey's most interesting article on long distance wireless systems and stations. The first half appeared in the July issue of THE WORLD'S ADVANCE.

meters and the arc will consume about 100 K. W. of energy.

Another large transmitting station employing undamped oscillations has been erected by the Universal Radio Syndicate at New Castle, New Brunswick, Canada. This station is now in operation and is fitted with a Poulsen arc type of transmitter. It has not been definitely discerned with whom this station communicates, but it may be heard at certain intervals in the United States, testing. This station was designed with the idea of carrying on correspondence with the similar station located at Portsmouth, England. Such communication, however, has not been established.

Another highly successful long distance radio circuit is that of the Marconi Company between Bolinas and Marshalls, Cal., and Kahuku and Koko Head, Hawaii. These stations employ the rotary disc type of spark discharger giving feebly damped oscillations and a very clear musical note. The service rendered between these two points has been very satisfactory, so much so that the cables were compelled to reduce their rates in order to meet the competition. Owing to the fact that the transmitting and receiving stations on the Pacific coast and at Hawaii are separated by a number of miles, it is possible to carry on communication both ways simultaneously. In fact, this is the great feature of the Marconi long distance systems not yet attained by others. By this method they are not only enabled to handle traffic in both directions, but the operators also may break each other and request the instant repetition of a word or sentence.

Signalling is carried on between these stations at any speed desired, and it is proposed at a later period to operate them at a speed of 75 words per minute.

It may be interesting to the reader to know that the high potential circuits from the secondary of the transformer at these stations is interrupted by means of a specially designed high potential relay in turn operated by a smaller key. In fact, it is of interest to sum up the methods by which the signalling in these large stations is effected, viz.: (1) in the case of the spark stations, the high potential circuit from the secondary winding of the transformer to the condenser is interrupted by a specially designed high potential electro-magnetic break fitted with air blasts; (2) in the arc stations a portion of the aerial tuning inductance is shunted by a telegraph key, thereby changing the emitted wave length; (3) in the high-frequency alternator systems, the D. C. circuit to the field coils is generally interrupted by a telegraph key.

The universal use of arc stations is apt to cause a conglomeration of radio traffic for the reason that these sets emit two wave lengths, one of which is radiated when the transmitting key is up, and the second wave length when it is depressed, thus doubling the interference produced by the ordinary spark for generator stations. This may become a

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¶It is now a matter of history that the first "long distance" attempts at wireless communication took place on March 27th, 1899, when Marconi succeeded in sending messages between the station at Wimereux, near Boulogne, France, and another at the South Foreland Lighthouse, on the Goodwin Sands, England. The total distance traveled by the signals was about thirty-two miles, and so remarkable was the feat considered that newspaper men from almost every nation were present to witness the tests. A ten-inch spark coil was employed to transmit the signals, which were detected by a coherer and recorded on a paper ribbon by means of a Morse register.

¶Sixteen years have elapsed since the English Channel experiments, and the meaning of "long distance" wireless communication has been constantly altering on an ascending scale. Today a long distance radio station can send and receive messages thousands of miles: the Arlington station keeps in touch with the Pacific coast stations; the Eiffel Tower station in Paris communicates with stations in Russia; the powerful Marconi stations in England, which have been taken over by the British Government, transmit orders to warships in the distant Mediterranean and, perhaps most remarkable of all, the Nauen and Eilvese stations in Germany permit of communication with the outside world.

serious hindrance to stations working on other wave lengths.

Within the past several weeks the Tuckerton station has been engaged in making comparative tests between Tuckerton and Eilvese of the arc and Goldschmitt high-frequency alternator. In fact, they have been alternatively employed through the days' schedule. It is generally understood as a result of these tests that the arc set carries further than the high-frequency generator, but the note produced by the arc has no where near the purity of that obtained by means of the generator.

In the third method referred to at the beginning of this article, viz., the high speed, high-frequency alternator, outside of experimental laboratories it has not been employed for commercial work. The initial speed of this machine is so high (20,000 r. p. m.), that they are not yet considered as a commercial proposition.

The General Electric Kenotron is a new-comer in the field of radio telegraphy, and is, in fact, a special form of vacuum valve oscillator comprising a hot filament and a cold plate placed in vacua. When a direct current is made to flow between the filament and the plate and is in turn shunted by an inductance and capacity, the Kenotron becomes a generator of undamped oscillations, which may in turn be transferred to an antenna circuit by means of an oscillation transformer. The Kenotron is exhausted to the highest possible degree—practically a perfect vacuum is obtained. At the present writing the output of this type of undamped generator is limited, but future experiments may reveal that a number of these can be placed in parallel, and if so it will probably take the place of the high-frequency alternator or the Poulsen arc.

It would seem from a review of the various systems just described that we are on the eve of important developments and extensions of long distance radio service and that within the very near future a number of extremely long distance radio circuits will be available for communication with foreign countries, giving the same degree of accuracy as the ordinary cable.

TIFFIN RADIO CLUB

The Tiffin Radio Club has recentiy been founded at Tiffin, Ohio, and the following officers appointed:

President, John J. Grossman; Vice-President, Paul E. Fredericks and Secretary-Treasurer, Harold C. Buck.

All the members of the Tiffin Radio Club have stations.

All correspondence to the club should be addressed to the President at 181 Hudson Street.

The Logarithmic Decrement

By H. B. Richmond

SINCE the passage of the radio act of August 13, 1912, the amateur, as well as many commercial, operators have come to realize that the operation of a radio transmitting set is no longer a merely hit or miss affair, but has become an exacting procedure. Resonance, damping, logarithmic decrement and many others are expressions with which they must be familiar. Probably as important as any, and at the same time the least clearly understood, is the logarithmic decrement. Although this term is by no means limited to radio work, it will here be considered only from that aspect. Let us first consider why the term has such an important place in radio work and then what it really means.

Suppose there were but four radio stations in the world and each station had identical equipment throughout. Let these stations be located at the corners of a square and A always work with A', and B with B', Fig. 1. Let all stations use the same power but operate on slightly different wavelengths. If B is receiving from B' and A and A' are working, B will experience interference from A and A'. Interference to the same extent will be experienced by A when A is rereceiving from A' and B and B' are working. The operators of the four stations then get together and agree to reduce this interference by adjusting their transmitting sets so that A will not hear B or B' and B hear A and A' for a distance of over ten turns on the primary of their loose couplers either side of the point of maximum strength. This is a rather crude agreement, but it serves its purpose by actually limiting the broadness of wave which the several stations may use.

Now let us go one step further and let any one of the four stations work with any of the other three. If A is working with B, B' may say B is all right but A is too broad. The reason for this being that B is farther from B' than A is. The energy received from B is accordingly less than that received from A and it will appear to B' that A is broader than B, although in fact they are both the same. Thus it becomes evident that some new method of measuring the broadness must be adopted. And as we increase the number of stations indefinitely using different types of apparatus, different powers, different wave lengths, etc., it at once becomes apparent that any method of measuring the broadness of a wave must take into account wave length, power and all other factors which enter into it. This is exactly what the logarithmic decrement does. It is a measure of broadness which will apply under all conditions of operation.

Before attempting to conceive of the meaning of the expression as applied to radio work, let us take an example which we can actually see worked out without the aid of any elaborate apparatus. Take a piece of twine or fine wire 39 inches long and fasten a small weight to one end, then suspend the pendulum thus constructed so that it will swing freely. Carry the weight to one side and carefully release it so that it will start swinging straight back and forth and not acquire a rotary motion: *i.e.*, its swing will be limited to one plane. It will be observed that the time required for the bob to swing from the perpendicular position at the lowest point of the arc of swing out to the end and back to the center is just one second. To start from the center, swing to the right, swing back past the center to the left, and then swing back to the center again will of course require twice as long as a swing from the center to but one side and back again, and accordingly will require two seconds. This full swing is a complete circle of events or *cycle*, and as *frequency* is measured in *cycles* per second we have a frequency of 0.5. If we had 25 complete swings per second we would have a frequency of 25 cycles. In addition to the fact that the time is remaining constant for each swing it will be noticed that the distance which the bob swings from the center is constantly

diminishing. Thus we have a pendulum whose time of swing, or *frequency,* is constant, and whose length of swing or *amplitude,* is diminishing.

Now let us make some measurements with this pendulum. On a piece of paper draw a line *OX,* Fig. 2, and divide this line into a number of equal spaces, *OC, CF, FM,* etc. Let each of these spaces represent the time it takes the bob to go from the lowest point of the arc to either extremity and return, *i.e.* 1 second. As it takes the bob just one-half of this time to go from the lowest point to an extremity, let us divide the given space into two equal parts, representing 0.5 seconds, and at these middle points erect perpendiculars alternately above and below *OX,* as *AB, DE,* etc. Now let us measure the actual swing of the pendulum. Suppose on the first swing it goes 12 inches to the right and 11 inches to the left. If we take some convenient scale, such as one inch to the foot, we can lay off on the perpendicular lines which we constructed the actual swing of the pendulum. Let swings to the right be laid off above and swings to the left below *OX.* We will get a series of points such as *A, E, G,* etc. If we take points in addition to the middle ones and measure the swing at these intermediate points, we will get a series of points through which we can draw a smooth curve, as shown in Fig. 2. This curve gives us a method of studying the relation of the amplitude of swing to the time of swing.

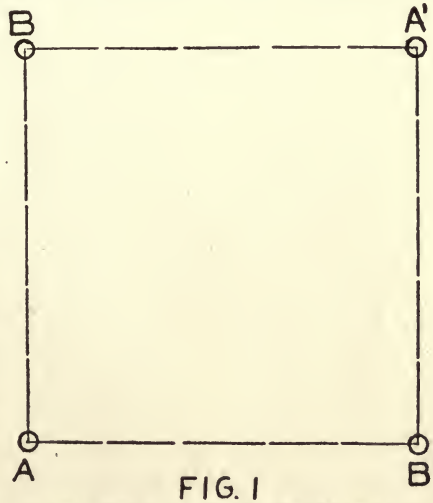


FIG. 1

Diagram Serving to Explain the Necessity for Sharply Tuned Transmitting Sets.

If we take the amplitude of the first swing, indicated on the diagram by *AB* and numerically equal to 12 inches, and compare it with the amplitude of the second swing *DE,* equal to 11 inches, we obtain a definite relation between the two, which is numerically equal to 12/11 or 1.09. A close study of the curve will reveal the fact that no matter where we take one perpendicular if we take the other in the corresponding place in the next loop in the opposite direction the ratio will always be the same and for this particular case, 1.09. The less the number of swings before the bob comes to rest, the greater will be the ratio between these perpendiculars. For this simple case we might stop here, for we have a perfectly definite measure of the characteristic of the curve when we state the ratio between the amplitudes of any two successive swings. For the comparison of similar curves this method is often used. But when we come to radio work it becomes especially desirable to go a step further in order to cover the case more completely. Instead of stopping with the simple ratio of the amplitudes of two successive swings taken in opposite directions we take *the natural logarithm of the ratio of the amplitudes of two successive swings taken in opposite directions.* This is what is defined as the *logarithmic decrement.* For the benefit of those who are not familiar with the subject, it might be well to stop a moment before going further to explain what logarithms are.

If we consider any real number whatsoever, we can establish a relationship between that number and every other number. Consider the number 10. 12 is 10 plus 2. 7 is 10 minus 3. 100 is 10 plus 90. 100 is also 10 times 10, or as it is more commonly written, 10^2. 1000 is $10 \times 10 \times 10$ or 10^3. It is perfectly evident that where we have a perfect power of 10 as 1000 that it is correct to write 10^3, but it is just as true for numbers which are not perfect powers. Let us consider 45. 10 is 10^1, and 100 is 10^2. As 45 is between 10 and 100 it must be 10 to some power between the first and second, and is actually found to be $10^{1.65}$. If we take

368, it is between 100 and 1000, or between 10^2 and 10^3, it actually being $10^{2.59}$. This number, which expresses what power of 10 the number under consideration is, is called the logarithm of that number with respect to base 10. Thus 1.65 is the logarithm of 45 with respect to base 10, and 2.59 is the logarithm of 368 with respect to base 10. Hence it is at once apparent that we can take any number as our base and express every other number as a power of that base; that is to say, every number has a logarithm with respect to every other number. Many of our every day computations are made by first expressing the numbers as powers of 10, then working out the computations and finally converting the numbers back again. Tables known as logarithm tables are found in many mathematical books, and express all numbers in powers of 10, so that by means of these tables much laborious work is saved.

For such calculations as the logarithmic decrement there is another base other than 10 which is used. This base is designated by the letter *e* and is numerically equal to 2.718. It is known as the hyperbolic or natural base as contrasted with the 10 base which is called the common or Briggs' base. It is beyond the scope of this article to take up the derivation of the number *e*, but it seems well to add just a word about it lest the subject of logarithms be left in too hasy a state for those not already familiar with it. Many mathematical curves, as for example the one under consideration, appear to have peculiar properties when considered from our decimal system of counting, but which are perfectly regular when considered with respect to the irrational number designated by *e*. Thus in order to simplify many computations they must be based on *e* rather than on our decimal system with 10 as the base. *e* gets its value from the expansion of the convergent series $(1+h)^{\frac{1}{h}}$ where *h* approaches O. Expanding by the binomial theorem we get

$$e = 1+\frac{1}{1}+\frac{1}{1\times 2}+\frac{1}{1\times 2\times 3}+\frac{1}{1\times 2\times 3\times 4}+\ldots = 2.718\ldots$$

If we consider *e* as our base, the logarithm of 45 would be 3.81 instead of 1.65 when we considered 10 as our base. Its meaning is similar in that 45 is $2.718^{3.81}$ just as we saw it to be $10^{1.65}$.

But let us now return to our curve. Instead of stopping with the simple ratio of *AB/DE* which we found to be equal to 1.09 we are to take the natural logarithm of this ratio. From a table of natural logarithms we find that 0.09 is the natural logarithm corresponding to the number 1.09. Our logarithmic decrement per half period is therefore 0.09. To get it for a whole period it is merely necessary to multiply by 2 and get 0.18 as the decrement, which latter figure is the logarithm of the ratio obtained by taking *AB/GJ*. Here is one place where our logarithmic expression is an aid to us. The logarithm of any ratio of corresponding perpendiculars taken any number of loops apart is equal to the logarithm per half period multiplied by the number of loops below the one in which the initial perpendicular is measured. No such relationship exists in the simple ratio.

When we come to radio telegraphic work we have a condition similar to that illustrated by the string. A condenser is charged until the voltage is sufficient to break down the spark gap, then we get a rush of energy through the closed circuit which sets up a current in the open antenna circuit. This current in the antenna circuit may be likened to the swing which we gave the bob. It is greatest at the instant we start it, swings back and forth, gradually dying out to 0. The time of swing is constant but the amplitude is decreasing. While we cannot measure it with a yard stick, the way we did for the pendulum, it is possible to photograph the discharge, and the result will show a curve exactly the same as developed by the string. The perpendiculars such as *AB* representing the currents and the distances along *OX* the time required per oscillation. Instead of requiring two seconds for a complete oscillation, or cycle, the time is now but a small fraction of a second, the actual time depending on the wave length. For 200 meters this time per complete oscillation is 1/1,500,000 sec. Compare this frequency of 1,500,000 cycles with 0.5

obtained with the plain string!

We can now take the ratio of corresponding amplitudes in any two loops and obtain the logarithmic decrement exactly as we did for the string curve. Suppose we take the ratio of *AB* to *DE* and get 1.09 as we did for the string. The logarithmic decrement per half period is accordingly 0.09 and 0.18 for the whole period. Our set is, therefore, tuned within the requirements of the radio act which says, "At all stations the logarithmic decrement per complete oscillation in the wave trains emitted by the transmitter shall not exceed two-tenths except when sending distress signals or signals and message relating thereto."

Unfortunately it is not as easy to construct the curve for a radio transmitter as was the case with the pendulum, and in general other means have to be resorted to in order to compute the decrement. Several ingenious devices have been developed for this purpose, the most notable of which is the direct reading decremeter and wave meter designed by Mr. Frederick A. Kolster of the Bureau of Standards. This is the form of decremeter used by the U. S. radio inspectors and it is mounted in a leather suit case, in order to make it suitable for transportation on inspection tours. An excellent description and mathematical discussion of this decremeter by Mr. Kolster himself is found in Volume 3, No. 1, March, 1915, issue of the *Proceedings of the Institute of Radio Engineers.*

To all operators who have worked in congested districts the effect of a high decrement is known only too well. The higher the decrement the less oscillations per train and the broader the wave. For a decrement of 0.2 per complete period there will be about 15 waves per train. It is beyond the scope of this article to go into the causes and effects of a large value of the decrement, but it may be said that the decrement will be high when there is a high resistance in the circuit, when there is a transfer of energy back and forth between the primary and secondary circuits, or when the two circuits are not tuned to the same wave length. These two last conditions are nearly of the same character. The result is a broad wave, and as the energy is not concentrated over a short space the damping or decrement will be high.

To sum up, it may be said that the

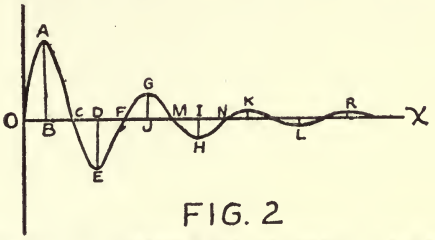


FIG. 2

Diagram for Explaining the Decrement of a Pendulum.

logarithmic decrement is a convenient measure by which the damping of a circuit may be determined. The clause in the radio act of Aug. 13, 1912, defining the maximum value of the logarithmic decrement, sets a standard for the maximum amount of damping permitted to be used by any station. It is desirable to have the damping or logarithmic decrement small in order that the emitted wave will be sharp and can be readily tuned out by stations not desiring to receive that wave. Distress signals should be sent with a relatively large value of the logarithmic decrement in order to have a sufficiently broad wave to attract the necessary attention. The correct adjustment of a transmitting set for a logarithmic decrement below 0.2 is just as essential as having the correct wave length.

RADIO SECTION OF THE SEPTEMBER ISSUE.

The Radio Section of the September issue will contain several short, constructional articles, as well as longer articles, dealing with advanced phases of wireless engineering. One of the latter articles will be by Mr. A. S. Blatterman, and will cover many points that are not clearly understood by the majority of wireless amateurs. The policy followed in the past few issues, namely, that of presenting long articles of an authoritative nature and prepared by well-known writers in the field, will be continued, although there will be quite a number of short contributions similar to those that characterized the Radio section of previous issues.

The Danger of Hertzian Waves

By B. S. Blakee

THE discharge of an electric spark is the source of radiant energy capable of producing at a distance upon an electrical apparatus called a "resonator" powerful vibratory movements which are liable to give rise to other sparks. This phenomenon was first observed by the German physician Hertz, by means of a metallic circle cut in such a way as to leave the free ends close together, placed in an oscillating field of induction. This principle has been made use of recently in England to cause an explosion in the hull of an old ship lying at some distance from a wireless station. The details of the operation have been kept secret, but a similar experiment may be made with the following simple apparatus:

Fill a glass flask with an explosive mixture of oxygen and hydrogen (two volumes of H to one of O) and close the mouth of the flask with a stopper of paraffin through which have been pushed two steel needles with blunt and polished points, so that they approach at an angle and leave a small space between the ends. Now connect the needles to long insulated wires, which may be extended to the earth or hung on brackets in opposite directions. If operated in stormy weather, or in the neighborhood of a wireless station, one will not have to wait long for a spark induced by an electric wave, which will cause the explosion of the gases with a report like the crack of a pistol.

This experiment of the English Admiralty is probably the first in which these waves have been voluntarily used to cause destruction, but it is not certain that the destroyed ship is the first victim of electric resonance.

The accidental occurrence of the Hertzian experiment is perhaps more common than is imagined, on account of the numerous resonators which chance leaves in the paths of the electric waves. It is only necessary that such conditions be present in an inflammable medium to cause a fire.

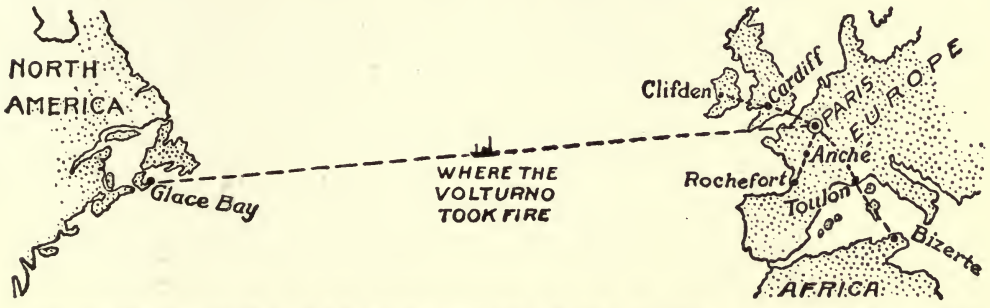
M. Duroquier, writing in *La Nature,* says that he would be sorry to cause unnecessary alarm to sailors, miners and aeronauts, but the memory of recent catastrophes in which many lives have been lost leads one to believe that special care should be taken under certain conditions and in certain localities to counteract the effects of the electric waves which reach to the depths of a mine as readily as they reach a ship at sea or a dirigible balloon in the air.

On board ship some chain, or perhaps scrap iron in the coal bunkers may cause sparks which will start a fire. In the case of a battleship, shells lying close together in a badly ventilated ammunition vault may be exploded by the same means. To cause the firing of a dirigible, all that is necessary is the formation of sparks across some gap in the metallic frame-work.

Numerous instances may be cited of the inductive effects of these waves. At the wireless post at Mont-Valerien, several miles from Paris, the emissions from the Eiffel Tower give rise, by resonance, to sparks several millimeters in length at the point of the detectors on the receiving table. On shipboard, also, this effect can be observed in the metallic rigging when the wireless is in operation.

Continuing, M. Duroquier says that the dangerous effects of induction are to be feared not only under a storm cloud, or near a radio-telegraphic station, but especially at points halfway between two powerful stations. He noticed that at his own wireless station some of the delicate instruments were frequently out of order from some unknown cause and by drawing a straight line on a map from Paris to the nearest wireless station, situated at Rochefort, he

found to his astonishment that his own station is just midway between the other two. By connecting the various large stations in Europe and America, he made have occurred on a number of French warships; and that halfway between Paris and Clifden, Ireland, is Cardiff, at which disastrous mine explosions



Map Showing the Location of Several Powerful Wireless Stations, the Waves of Which Are Said to Have Caused Disasters.

the further discovery that halfway between Glace Bay and Paris is the region in which the *Volturno* took fire; that halfway between Paris and Bizerte on the north coast of Africa, is the harbor of Toulon, where explosions have taken place in the recent past.

Possibly the recent burning of a Zeppelin airship may be put down to the same cause, but in any case it would seem wise to take special precautions against fire in these localities.

CONNECTICUT VALLEY RADIO CLUB

The Connecticut Valley Radio Club with headquarters at Springfield, Mass., recently elected the following officers: President, Glen Sabin; Vice-President, Dean A. Lewis; Secretary, George F. Beecher and Treasurer, F. K. Ostrander, Jr.

The club was organized on December 8th, 1913, with an initial membership of eight. A recent membership campaign has resulted in a considerable increase, and it is hoped that there will shortly be at least fifty members.

The vice-president of the club holds a special Government license and has communicated with other wireless stations 1,800 miles away. Anyone desirous of getting into communication with the club may do so by calling IZL, which is the call of the vice-president's station. Correspondence is also solicited and may be addressed to the Secretary at 416 Allen St., Springfield, Mass.

A NEW WIRELESS CLUB FORMED AT BUFFALO

There has recently been formed at Buffalo, N. Y., a wireless club with its headquarters in the Buffalo Y. M. C. A. building, where members are given instructions. Mr. Rice is in charge of the wireless class, while the officers of the club are: President, H. L. Moershfelder; Vice-President, Russell Paris; Secretary, Emil Ferris and Treasurer Wm. Feuchter.

NEW WIRELESS TELEPHONE.

The General Electric Company has recently been conducting experiments with a wireless telephone system of their own design and manufacture, between the plants at Schenectady and Pittsfield. It is said that ranges in excess of fifty miles have been covered without difficulty.

What the World is Doing

BY the end of the current year approximately 10,000 workingmen will have been killed in the pursuit of their daily tasks! In this sentence, the opening one of a noteworthy article in the present issue, the reader will find food for thought. For the greater part these unfortunate men are engaged in supposedly safe occupations, many of them working in factories and meeting their fate through faulty equipment or through sheer carelessness on their part.

With the inauguration of the Safety First movement, all manner of protective coverings and guards were devised to shield the operator from the dangers of his machine, and there is little excuse for the factory owner who wilfully neglects to safeguard his employees by covering the moving parts of the machinery. The expense is slight and the feeling of security is conducive to better and faster work on the part of the operator.

But the matter of safety does not always rest with the employer. The workman must also do his part. Many accidents, seemingly trivial in themselves but far-reaching and pernicious in their effects, are the direct results of plain carelessness and thoughtlessness on the part of the workman. For instance, in a foundry two workmen may be standing side by side, chipping burrs from rough castings; a chip flies off at a blow from the hammer of one of the men and strikes his companion in the eye. Such accidents happen almost daily under conditions where no actual machinery is used. The result may be the loss of the eye and once one is affected, the other is likely to follow its mate. Such an accident could positively be prevented if the workmen were to stand one in front of the other instead of side by side or facing each other.

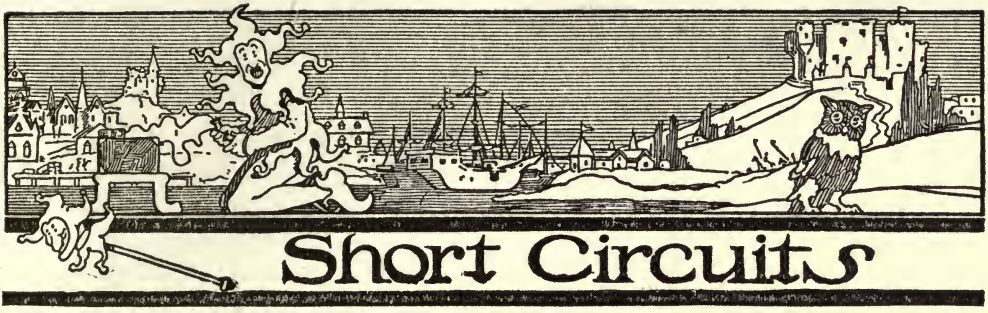
It is the little things that count in any walk of life. Let the employer do his part to be sure, but—and what is of even greater moment—let the employe enter into the spirit of Safety First with a will and a determination to lend his individual efforts to the common cause—the elimination of careless, inexcusable accidents.

WHAT is your definition of a person worth while? Of all the people you have met can you not pick out a certain few who have impressed you as being particularly interesting, who have made you feel that you wanted to see them again, to know them better? Are not these very special people the ones who have talked to you about *things* rather than *persons?* Ofttimes we hear a man spoken of as one who does things—a man of deeds. Do we not unconsciously weave a halo around his head when we speak or think of him?

The mind of a growing boy is plastic and upon his early training and surroundings depends to a great extent the form it will take in later life. The receptive young brain yearns instinctively for knowledge and the boy's habits are largely the result of a mere suggestion here and there. The creative instinct is strong within the average healthy boy —he wants to make things with his own hands—wants to see them grow under his guidance.

This inborn desire of the boy to accomplish things should be encouraged. Let the boy have his little workshop in a corner of the attic; let him build things and devise ways and means to overcome obstacles that arise through lack of proper tools—the development of this quality of self-reliance will stand him in good stead in later years when he brushes up against the world. Let the youngster take his camera into the woods and fields in the summer—encourage the feeling that he is actually producing something. In the course of a few years he will begin to sense the possibilities of making money out of his hobby, whatever it may be, and this will mark the awakening of the business instinct in him.

The athletic development of the boy is natural and of vital importance. In no sense should the above remarks be construed to mean that the boy is not to be encouraged in his play. The life of a normal individual should, however, be made up of about equal parts of work, play and rest. Work is just as essential to the well being of the boy as it is to the adult; but to the youngster the work must take a form that makes it seem like play. Just as his games develop his muscles so should his work mould his mind and develop his natural desire to do things.



"Why don't you marry, old chap?"

"Do you think a man could procure all the necessities of life on $1,800 a year?"

"Of course; but not the luxuries."

"Well, I haven't decided yet whether a wife is a necessity or a luxury."—*Boston Transcript.*

⁂

"What do you make of his name?" asked the police chief.

"Well," responded the great detective, "from the spelling, I should judge that he's either a parlor car or a Russian dancer."—*Philadelphia Ledger.*

⁂

"The great trouble with the American people is that they eat too much," said the doctor.

"Nonsense," retorted the statistical person. "I can easily produce figures to prove that one-third of the American people live in boarding-houses."—*Judge.*

⁂

Wild-eyed Customer—I want a quarter's worth of carbolic acid.

Clerk—This is a hardware store, but we have—er—a fine line of ropes, revolvers and razors.—*Yale Record.*

⁂

Once upon a time a man invented glasses with which people could see their own faults. He starved to death.—*Cincinnati Enquirer.*

"I would I were a bird," she sang.

"I would you were," said her husband. "You could go South for the winter without its costing me anything."—*Life.*

⁂

Knicker—What succeeds that tired feeling?

Bocker—That fired feeling.—*New York Sun.*

⁂

"Why did the great pianist refuse to play?"

"Temperament. He got mad because his name was printed in smaller type on the program than the name of the piano."—*Chicago Record-Herald.*

⁂

Trott—Well, my dear, did you enjoy your shopping trip today?

Mrs. Trott—No, I didn't. I found exactly what I wanted in the very first store I entered.—*Boston Transcript.*

⁂

"Is he a credit to his family?"

"No; a debit."—*"Concord Herald.*

⁂

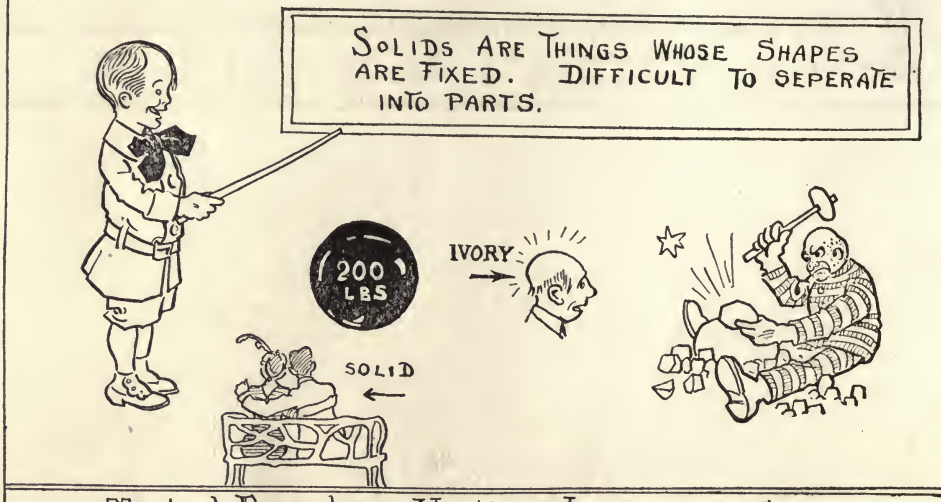
"Penley used to think his poems were immortal."

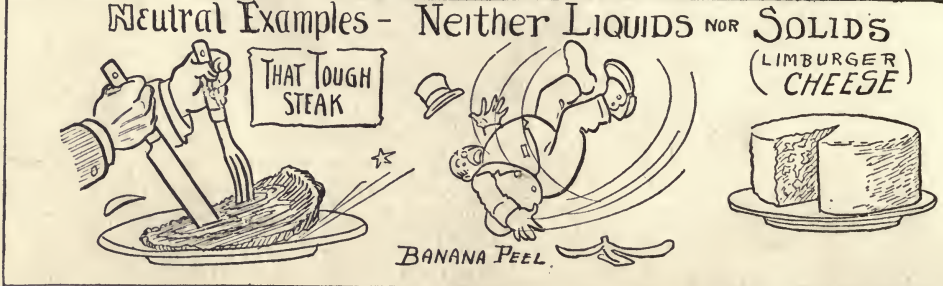
"What changed his opinion."

"The editors 'killed' so many of them."—*Boston Transcript.*

Scientific Sammy on Solids and Liquids

In Two Comprehensive Chapters





The World's Advance

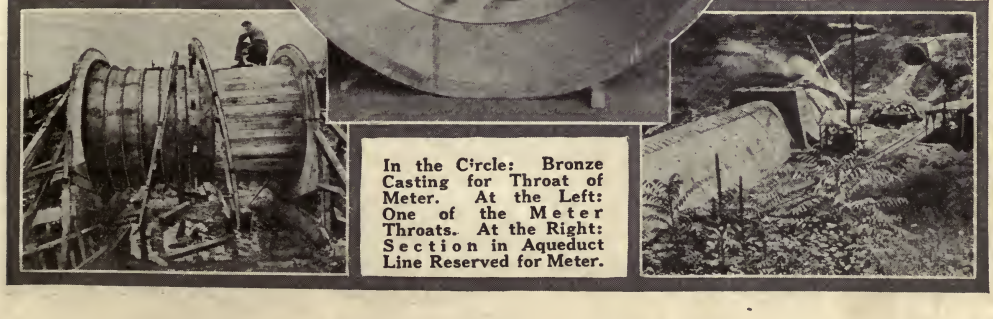
Vol. 31 SEPTEMBER, 1915 No. 3

How New York Will Measure 500,000,000 Gallons of Water a Day

By Charles W. Person

GALILEO said in 1700 that he could learn more of the movements of Jupiter's satellites than he could of the flow of a stream of water. Ninety-seven years later, however, an Italian philosopher, J. B. Venturi, discovered a principle which enables the engineers of this century to measure accurately and quickly any given quantity of water from a drop up to a billion gallons and more. It is this old Italian's principle which makes possible the method and apparatus for measuring the flow of water through the Catskill Aqueduct.

The completion of the Catskill Aqueduct will provide means of delivering to New York City a daily water supply of at least 500,000,000 gallons, through its 100-mile chain of dams, aqueducts, pressure tunnels and steel pipe siphons. A comprehensive plan for determining how much water the Aqueduct will deliver has been developed, and three meters will be placed at three



In the Circle: Bronze Casting for Throat of Meter. At the Left: One of the Meter Throats. At the Right: Section in Aqueduct Line Reserved for Meter.

points in the line, so that a continuous record of the actual flow will be available.

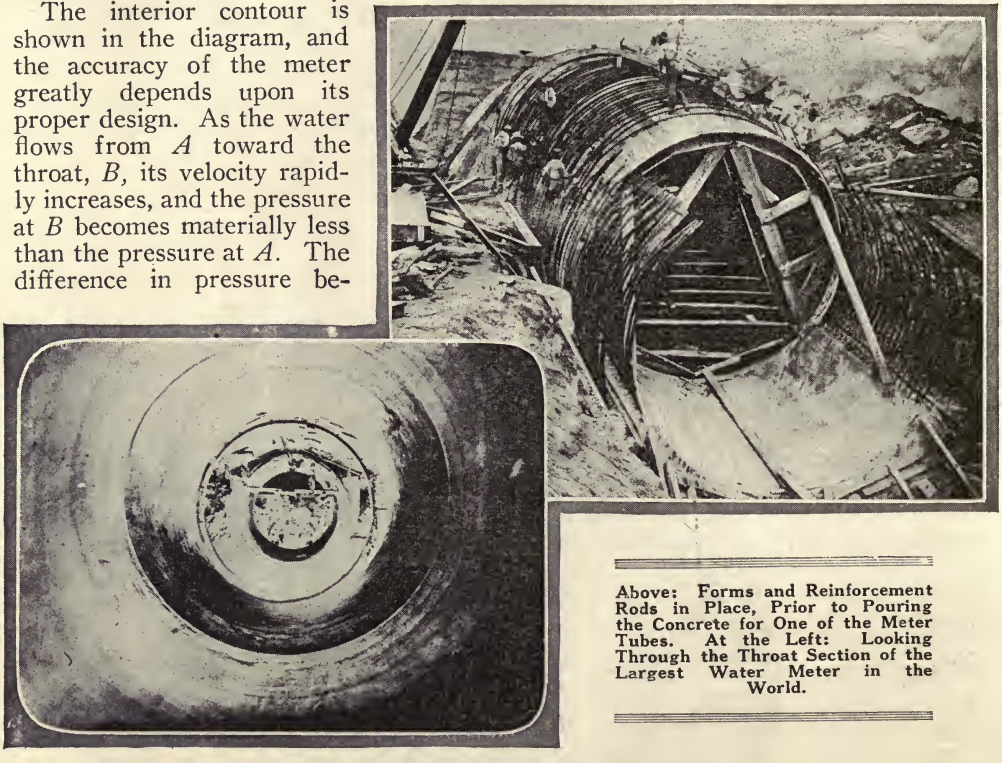
These meters are on a colossal scale; in fact, they are the largest meters ever built. At the upstream castings the diameter of the waterway is 17 feet 6 inches, and at the throat of the meter the diameter is 7 feet 9 inches. Each meter is based upon the principle of the conservation of energy, and each consists of a contracted section, or throat, the function of which is to introduce an artificial depression.

The interior contour is shown in the diagram, and the accuracy of the meter greatly depends upon its proper design. As the water flows from *A* toward the throat, *B*, its velocity rapidly increases, and the pressure at *B* becomes materially less than the pressure at *A*. The difference in pressure between *A* and *B* can be accurately measured, and bears an exact ratio at all times to the flow through the throat *B*.

After passing the throat the velocity begins to decrease with an accompanying rise in pressure, and when *C* is reached the pressure temporarily lost at *B* has been almost entirely regained. Therefore, a properly proportioned tube not only provides a basis for accurate measurement of the flow, but it delivers practically the same amount of water as a straight pipe of equal length and diameter.

In order to fix the location of these huge measuring devices it may be advantageous to review briefly the principal parts of the Catskill system. The water will be collected in the Ashokan reservoir, 100 miles north of New York, and will flow south by gravity through the aqueduct to the Kensico storage reservoir, about 30 miles from the city. From the Kensico reservoir the water will be delivered into an equalizing basin at Hill View, and from this point the flow will be carried to points of connection with the city's distribution system by means of a deep pressure tunnel in rock, driven the entire length of Manhattan Island. The first of the three large meters is located at the outlet of the Ashokan reservoir; the second is at the inlet to the Kensico reservoir; and the third is at the outlet from the Kensico reservoir.

All the meters are built in the aqueduct line and will carry the full flow. There are several reasons for using three meters instead of one. On a conduit the length of the Catskill Aqueduct there is



Above: Forms and Reinforcement Rods in Place, Prior to Pouring the Concrete for One of the Meter Tubes. At the Left: Looking Through the Throat Section of the Largest Water Meter in the World.

certain to be leakage at some points and infiltration of ground water at others. The measurement of the flow at the Ashokan reservoir, therefore, would not be a true index of the amount delivered to New York City.

By putting in a meter at Ashokan and another at the inlet to Kensico and comparing the volume of the flow recorded at each of these points, it is possible to determine accurately just how much water is lost by leakage or gained by ground water seepage.

The third meter at the Kensico outlet is necessary to determine the quantity of water actually delivered into the city distribution system. It is possible that the aqueduct may be delivering water into the Kensico reservoir at a time when none is being withdrawn, or that the aqueduct supply may be cut off when the Kensico water is feeding into the city distribution system. Under conditions such as these it is apparent that one meter would not be sufficient to give the data desired regarding the quantity of water.

Each meter is built of reinforced concrete, with a bronze lining and annular pressure chamber at the throat and a

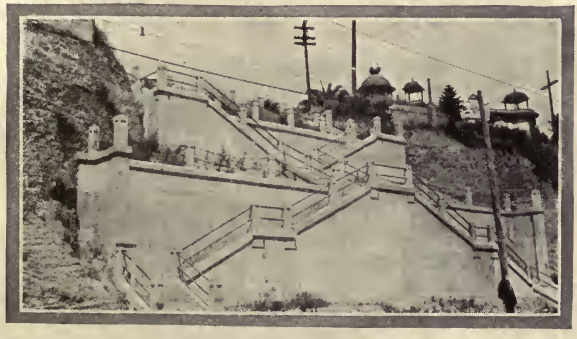
A Simple Diagram to Indicate the Action of the Water Meters Used in the Catskill Aqueduct.

second bronze pressure chamber at the upstream end of the tube. It was desired always to have the throats of the meters full of water, and for this reason the tubes were built as inverted siphons with the throats 18 feet below the hydraulic grade line.

The length of the depressed section is about 408 feet, including 30 foot transition lengths at either end which convert the 17-foot horseshoe section into a 17-foot circular section. The length of the tapered portion of the meter on the upstream end is more than 26 feet and at the downstream end more than 111 feet. When one considers that the ordinary meter is not larger than the palm of one's hand, the extraordinary size of these huge meters can be realized.

CONCRETE STAIRWAY OPENS A STREET BLOCKED BY A HILL

The accompanying illustration discloses a novel way in which a city in the western part of this country "opened" a street, the end of which ran into a deep cut of about sixty feet in height.



A Stairway of Unusual Design, which was Constructed in Order to Open a Street.

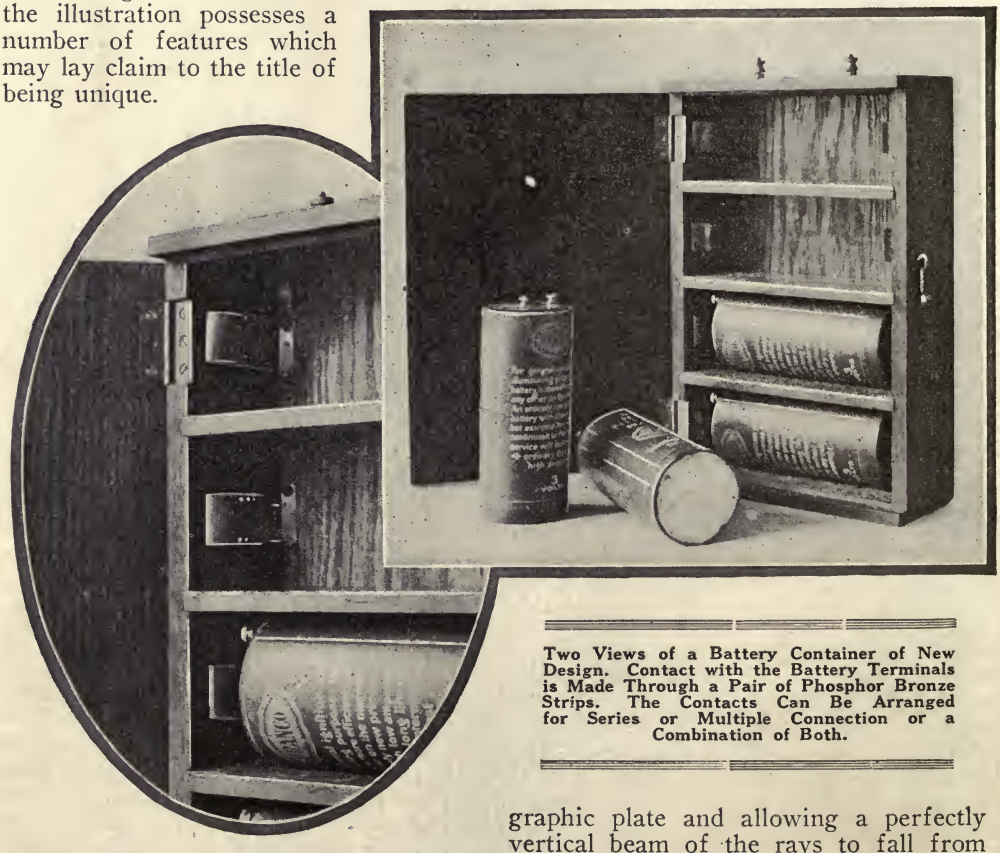
The improvement consists of an elaborate set of concrete steps of unusual design. At the bottom there are two entrances to the stairway. After a short flight at these entrances these series of steps turn and run toward each other, meeting in the center and continuing upward for about twenty steps. From this point they again part, going outward until they are about fifty feet apart, at which point they again turn up the hill, continuing to do so until they reach the top of the grade, when it is found that each of the series of steps is directly

even with either of the sidewalks of the street above.

The concrete work in this instance is reinforced with strong steel rods one-half and three-quarter inch in diameter. At all sides of the steps, where there is no wall cement, column and pipe railings have been provided. The entire concrete work has been given a sanded finish.

A BATTERY CONTAINER THAT CONNECTS ITSELF

Every user of dry cells in quantities knows the value of a device which makes it unnecessary to connect each cell when it is put in the place of an exhausted one. While several practical methods of accomplishing the desired result have been suggested and put into operation, the arrangement shown in the illustration possesses a number of features which may lay claim to the title of being unique.



Two Views of a Battery Container of New Design. Contact with the Battery Terminals is Made Through a Pair of Phosphor Bronze Strips. The Contacts Can Be Arranged for Series or Multiple Connection or a Combination of Both.

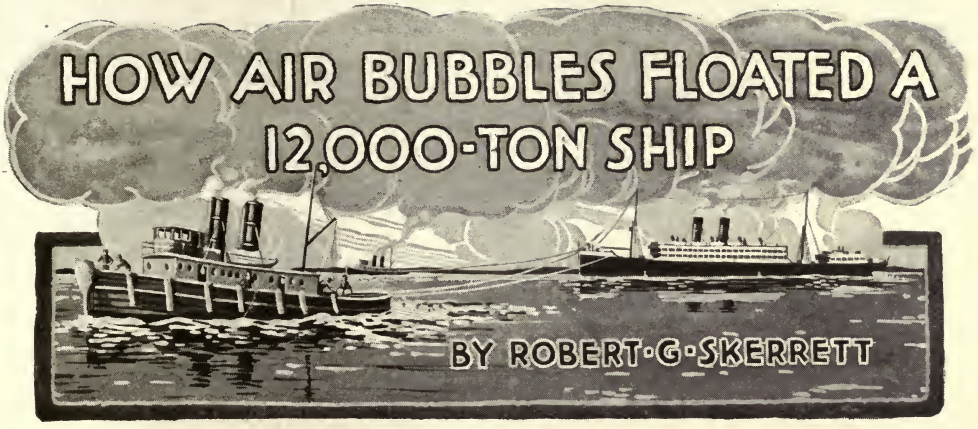
The contact device in this container consists of a pair of phosphor bronze spring strips, one of which makes connection with the carbon and the other with the bare zinc at the bottom of the cell. Thus it is obvious that by merely removing the paper carton from the cell, or cutting the bottom out of it and pressing the cell into place, the connection is made and the battery secured in place almost instantly.

The contacts can be arranged for series or multiple connection or a combination of the two.

TINY X-RAY PICTURES

Professor Pierre Goby appears to have been the first man to obtain photographs of very minute specimens by the use of the X-rays, such as diatoms and the like, which have about the size of a grain of sand. This he does by placing the specimens directly upon a photographic plate and allowing a perfectly vertical beam of the rays to fall from the bulb above, through a special tube so as to properly direct the rays on to the object.

HOW AIR BUBBLES FLOATED A 12,000-TON SHIP



BY ROBERT·G·SKERRETT

IT was a most unusual problem that confronted the American engineer who undertook refloating the "Zeeland," grounded on a mud bank in the St. Lawrence River, within three days' time. The task was to be so accomplished that the steamer could immediately proceed to Montreal, take on war supplies and depart for England; no damage of any kind that would further delay the steamer's sailing was to be incurred in the refloating. How the vessel was freed by the application of compressed air within ten minutes after starting the actual operations is a typical instance of the adaptation of simple principles to gigantic and seemingly impossible enterprises.

THE skill of the engineer is not always proved by originality; he shows his cunning equally by adaptation of other men's work. In other words, resourcefulness is his trump card. Proof of this capacity to profit by the labors of others was shown in the clever way in which Mr. W. W. Wotherspoon, of New York, succeeded in refloating a stranded ship of nearly 12,000 tons.

All of us were very much interested in the work of the army engineers when they raised the wreck of the old battleship *Maine* from the bed of Havana Harbor. As can be recalled, a novel cofferdam was built completely around the hulk, fencing it in, so to speak, with an elliptical wall of steel and mud; the unit cylinders being filled with the stuff dredged from around the wreck. With this done, the enclosed space was pumped out slowly until the shattered body of the battleship was finally exposed to the air and sunshine.

But the object of the undertaking was to refloat a large part of the craft so that it could be bodily removed to the deep waters of the Gulf Stream and there sunk for good and all. After draining the cofferdam space the task was not finished by any manner of means, for the tenacious clay underlying the silt of the harbor bottom gripped the ship. To refloat her this hold had to be broken, and the operation was accomplished in the following manner: Holes were drilled through the bottom of the

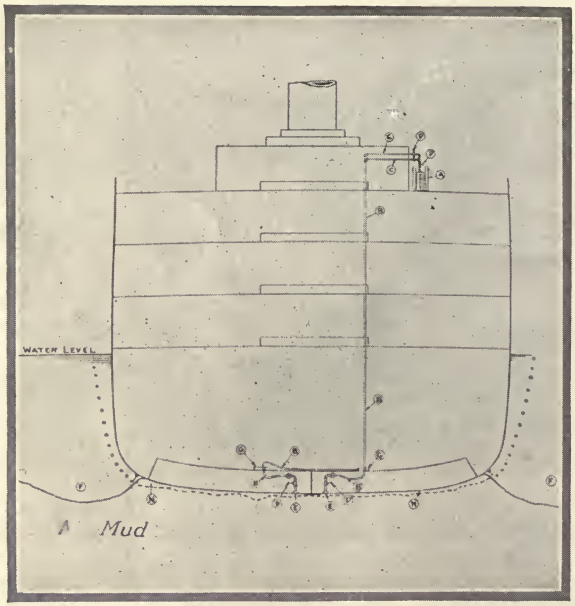


Diagram of the "Zeeland's" Position on the Mudbank, as Well as the Method of Installing the Piping Through Which the Compressed Air Was Forced for Blowing Out the Mud Beneath the Vessel.

hull all around the contour of the craft, and through these water jets were sent to break the seal between the steel plating and the surrounding clay. These jets answered their purpose well, saved an immense amount of excavating, and freed the wreck so that it floated when the enclosed space was refilled with water. Now for the novel manner in which Mr. Wotherspoon applied the lesson thus taught him three years ago.

The steamship *Zeeland* was on her way up the St. Lawrence from England early last November. Although there was fog in that treacherous river, the steamer sped on, for she was after a war cargo and her object was to reach Montreal and to be off again as soon as possible. Luck was against her and she ran aground about midway between Quebec and Montreal and pushed so high upon the mud that she was raised nearly three feet above her light load line. The season for ice was near at hand and there was fear that she might be caught and held for the winter in the river. If the ship was to be freed in time her refloating must be accomplished shortly, but she was so firmly stuck in the mud that it was quite impossible to pull her back into the channel even with the aid of a flotilla of the big ocean-going tugs of the St. Lawrence.

At this stage of the game the salvors were about decided to drop some of the bottom plates out of the ship, charge the overlying compartments with compressed air, and count upon the escaping bubbles to break the seal between the ship's bottom and the gripping mud. As a preliminary, a channel had been dredged on each side of the *Zeeland* and thence sternward out to the main waterway. But the dredges could not get under the vessel, and, therefore, she rested upon a mound of clay which held her fast. Now, the releasing of a number of the bottom plates, by cutting the rivets from the inside, might have answered to free the liner, but then she would have had to go into drydock at Montreal for repairs before she could be made fit again for sea and ready to take on cargo. Each day was precious, and the closing of navigation unpleasantly near. What was to be done? Here is where Mr. Wotherspoon was called into council and asked to take charge of the refloating of the ship.

It was Sunday, and he was given until Wednesday to get the steamer free, and it was a case of "no cure no pay." Besides, he was to avoid any delays due to repairs. After making some examinations, he accepted the job.

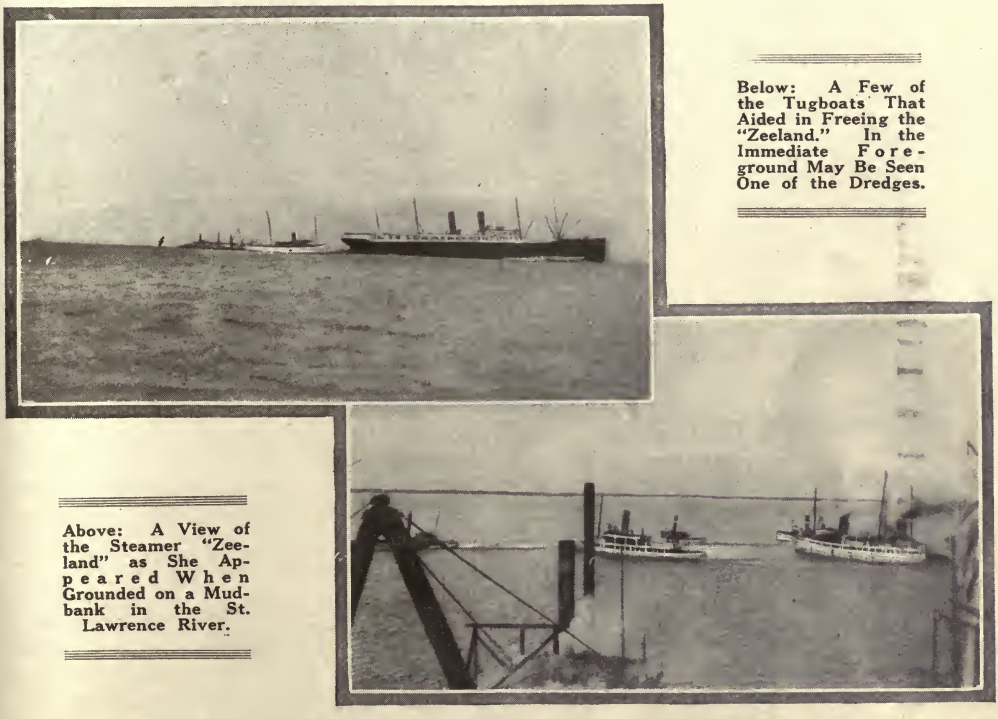
Most big ships have screwed into their bottoms from the outside a double line of bronze plugs spaced at intervals from stem to stern. These are called drainage plugs and are withdrawn when the craft is in drydock so as to free any water in her bilges or double bottom. The *Zeeland* was provided with these plugs. Mr. Wotherspoon removed fourteen of them, seven on each side amidships, and at such intervals that they spanned the length of the ship where she rested deepest in the mud. The

plugs were tapped with two holes on their inner ends, and with key wrenches it was an easy thing to screw them outboard and clear of the ship.

As these holes were threaded and had a diameter of more than an inch, they were all ready for the attaching of pipe fittings, and this was done so quickly that only a little ooze forced itself upward and inboard. With these fittings in place, rubber hose was then connected to each one of them, and this flexible tubing, in turn, led to the feeds from an air compressor having a capacity of a thousand feet of free air per minute. In the meantime, all water ballast was removed from the ship and her lifeboats and some other removable weights put over the side. Further, lines were led from the stern to five tandem teams of powerful tugs, and a separate wire cable was passed around the *Zeeland's* bow and led to the windlasses of the two dredges. These craft were firmly secured by their prods driven deeply into the mud. To facilitate guiding the liner, two smaller tugs were stationed at her head—one on each bow.

With everything in readiness, the ship's engines were backed, the dredges wound in on their windlasses, and the ten tugs at the stern pulled with all their might. Mr. Wotherspoon then let loose the compressed air through the fourteen openings in the steamship's bottom. The buoyant bubbles crowded surfaceward, and, in their struggle to rise, spread out and broke the contact between the steel plating and the tenacious clay. In this way the grip of the waterbed was destroyed, the liner lifted, floating, as it were, upon a film of air, and then it was an easy thing for her engines and the tugs to get her back into the river's highway. Indeed, inside of ten minutes from the starting of the joint operations the *Zeeland* was out in the channel and ready to move under her own power up to Montreal.

If Mr. Wotherspoon had used water instead of compressed air, as was done in the case of the *Maine,* the effect would not have been so broadcast, and it is doubtful if the fourteen small openings would have sufficed. Here is where he profited by the lesson taught him and



Above: A View of the Steamer "Zeeland" as She Appeared When Grounded on a Mudbank in the St. Lawrence River.

Below: A Few of the Tugboats That Aided in Freeing the "Zeeland." In the Immediate Foreground May Be Seen One of the Dredges.

Tandem Teams of Tugs Trying to Pull the "Zeeland" Off the Mudbank. There Were Ten of These Boats at Work, Among Them the Largest Sea-Going Tugs in the World, Representing a Total Pull of 14,000 Horsepower.

went his teacher one better by substituting another seal-breaking medium. As soon as the *Zeeland* was out in deep water, it took but a little while to break the hose connections, to withdraw the pipe fittings, and to replug the holes from within the ship. Thus was she made absolutely secure without going into dry-dock, no time was lost, and when she reached Montreal she was ready to take on freight and load up for the return voyage to England. This she did, and she left the waters of the St. Lawrence before the gathering of the ice.

WELDING FOUR THOUSAND FEET OF GAS MAIN

There has recently been completed at New Bern, N. C., the task of welding four thousand feet of four-inch gas main by means of oxy-acetylene torches.

Acetylene gas was supplied the torches from 100 and 300 cubic foot cylinders, and oxygen from 100 and 200 cubic foot cylinders. The contractors in charge of the work found that with reasonable care as to waste it was possible to obtain twenty or more four-inch joints with each 100 cubic foot cylinder of oxygen, and twenty-five or more four-inch joints with each 100 cubic foot cylinder of acetylene gas. It was also found that the welds could be made faster and better when working in the trench than on the level; the reason offered being that the torch draws an excess of oxygen from the air when burning in the wind and causes a tendency to burn the filling material. This difficulty would not occur on larger sized mains.

The Modern Way of Laying Gas Pipe is to Weld the Separate Lengths Together So as to Form One Continuous Piece of Metal.

Good joints were made in seven to ten minutes when working in a trench. In one afternoon fifteen leakless joints were made with only one torch, the apparatus being moved a distance of twenty feet after each weld. The pipe was tested under air pressure, using soap suds on the joints to detect leaks.

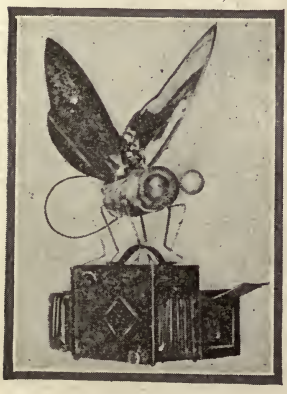
As a filling material No. 8 gauge soft steel wire was used, since it was found that this material flows better and has less tendency to stick than Norway iron.

A MINER'S BLAST THAT OPENED A BOTTOMLESS PIT

A miner's blast opened a subterranean pit of undetermined depth near Volcano, Nev., a small town eighteen miles north of Tonapah. A miner was lowered into the cavern for two hundred feet with a light to examine the opening. He reported that he could not find or see the ends of the fissure. Stones dropped through the opening could be heard bounding from wall to wall until the sounds died away—but no sound which would indicate the bottom was reached was heard. Lights showed sparkling stalactites hanging from the sides of the cavern.

A QUEER ELECTRIC BUG

Composed of electric light bulbs, and with wings of stained glass and legs of thin metal strips, the "insect" shown in the illustration forms the conception of a Kodak Bug, or at least that is the idea of the Los Angeles camera man who designed it. It is wired for illumination, so that when set in a show window it forms a display that attracts instant attention.



The "Kodak Bug"—the Attractive Window Display of a Photographic Supply Store.

By Lettering His Name and Occupation on an Old Sink, a Plumber Has Made An Effective Sign for His Business.

THE KITCHEN SINK AS A SIGN-BOARD

That the limit to novel business signs is not yet is demonstrated by the accompanying illustration. This plumber has created something new along this line by the painting of his name and business upon the bottom of a worn-out sink. The sink has in turn been fastened to the trunk of a tree in the front yard of the plumber's home.

JITNEY ROLLING CHAIR

The latest feature for the seaside resort is the jitney rolling chair. For years past rolling chairs have been operated at all of the beach towns of any importance, but it seems as though these man-operated affairs have at last seen their day. The unique bus seen in the accompany-

An Electrically Operated Rolling Chair Which is Being Operated at a Californian Seaside Resort.

ing view has just made its appearance at Venice, California. It is being operated between Venice and Ocean Park, a distance of about a mile. Between these points is a wide cement walk running along the ocean front, and it is along this walk that this "jitney" runs.

The novel car is twelve feet in length and is run by a two-horsepower electric motor. It attains a speed ranging from four to ten miles an hour. There is a seat running entirely around the central back-rest of the car, both the seat and the back-rest being upholstered. The car accommodates eighteen passengers in addition to the motorman, who also acts as the conductor. The fares are collected when the car is midway between the two cities and while the car is stopped.

BUILD YOUR HOUSE IN A TREE TO ESCAPE FLOOD

Floods and fires and the moths that corrupt one's earthly possessions have little terror for the householder who builds his home in the tree tops. The novel home shown in the accompanying view was erected near the banks of the river in one of the fashionable summer home suburbs of Des Moines, Iowa. After the home in the tree tops had been completed a short time the floods came, but they only served to demonstrate the wisdom of the builder rather than causing him any great inconvenience. The homes of some of the less fortunate neighbors can be seen at the water's edge, while others were partly submerged by the overflowing water.

The sleeping tent and the other accommodations of the home are built on a large platform which has as its support the trunks of four large trees. The ladder built alongside one of the pillars forms an easy means of reaching the tree top home. In addition to its safety features, this "nest in the trees" has the advantage of being cooler and free from ground dampness, as well as being less accessible to the crawly things that bring fear to the heart of the housekeeper.

A Shelter Erected on a Platform Among the Tree Tops Possesses Many Advantages.

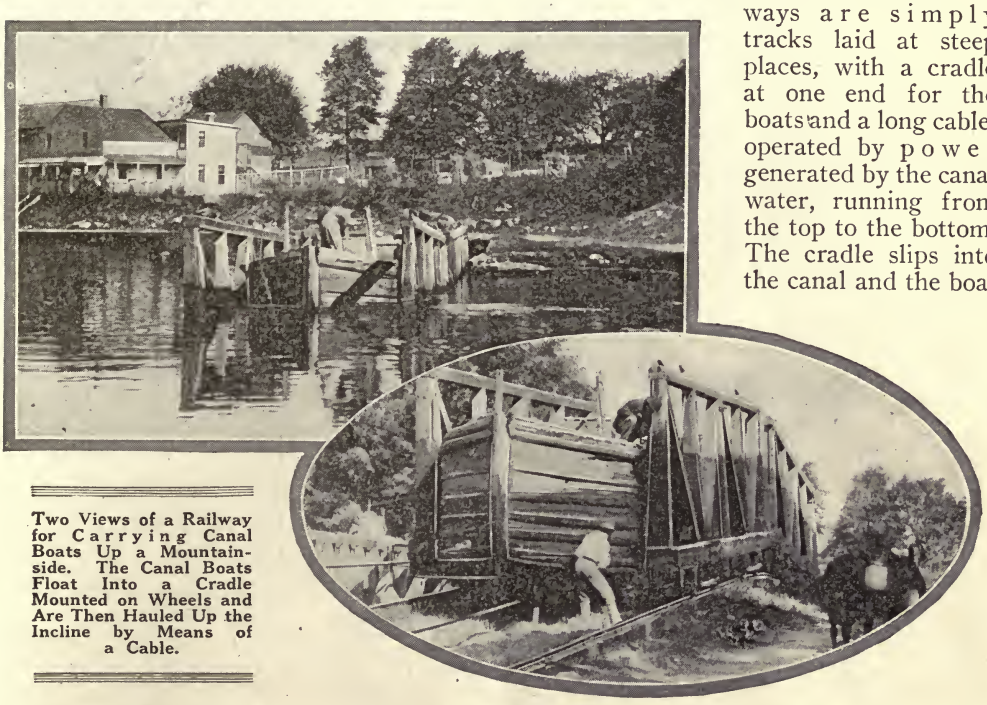
FELLING TREES WITH AN AUGER

Business men in India have urged United States Consul Baker to introduce a new type of portable timber felling machine. Many of the steep slopes of the Himalaya and other mountains are

heavily wooded, but the grade of fifty degrees makes ordinary sawmilling machinery useless because of the lack of level resting places.

It was suggested to the consul that possibly an auger, portable by hand, which could bore holes through a trunk radially with an electric motor, working automatically or by hand control, would be just the kind of appliance which would be very useful. The tool should be of sufficient strength and stiffness and be a sort of screw auger, able to clear itself after boring the desired holes.

If the timber could once be felled it could easily be lowered down the mountain slope to rivers or to any sawmills in level spaces below.



Two Views of a Railway for Carrying Canal Boats Up a Mountainside. The Canal Boats Float Into a Cradle Mounted on Wheels and Are Then Hauled Up the Incline by Means of a Cable.

A CANAL BOAT ON RAILS

The canal boat which climbs mountains to an elevation of a thousand feet and then crawls down to water level again is not a freak but just an ordinary, every-day craft that is engaged in carrying coal across the State of New Jersey to tide water. From the Delaware River to the Atlantic seaboard is a matter of about ninety to one hundred miles as the crow flies, but as the old Morris and Essex Canal runs it may be anywhere from one hundred to one hundred and fifty miles. To make this comparatively short trip, however, the canal boats must climb nearly a thousand feet above the sea level.

Locks are not sufficient to raise the boats quickly to the great elevation attained by the canal, so the boats crawl out of the water at several places and take to the railways. The inclined railways are simply tracks laid at steep places, with a cradle at one end for the boats and a long cable, operated by power generated by the canal water, running from the top to the bottom. The cradle slips into the canal and the boat floats into it. Then the two are hauled up to a higher level, and the boat once more resumes its journey by water. At one point on the Morris Canal there is a series of half a dozen of these inclined railways, and the canal boats climb several hundred feet over land in a short time. Everything is hauled up except the mule. He makes the climb on foot, and comes out on the tow path ready for another long, lazy pull. The canal boatmen usually take advantage of the opportunity when their boats are in the cradle to repair leaks and clean off the bottom. It is the only dry dock that the canal boats ever see.

Unusual Flower Containers for the Home

By Albert Marple

IT is very evident to the person who travels through the residential section of various towns and cities that little general effort is exerted to beautify the homes by the use of flower holders of various kinds and shapes. The general public is apparently unaware of the effect the "business" spirit of this day and age is having on the general appearance of the homes of our communities. There seems to be a feeling abroad which sounds something like this: "Anything will do for our homes, so long as our business progresses." This, then, may be considered as a sort of appeal for "back to the home."

The accompanying illustrations show that there are at least a few home owners who do not have business constantly in mind. They give a little time to the beautifying of their dwellings, and as a result their homes generally are prominent on their streets as a diamond would be if placed among a number of black beads. Their places have that "different" appearance and are comfortable dwellings.

Of the accompanying views the third shows a pretty flower box which may easily and at small expense be constructed against the side of a porch pillar. The heavy beams, which constitute the railing of this porch, continue entirely through the pillar, and it is to one of these that this flower holder is fastened. It is made of one-inch boards and is large enough to accommodate a pretty leafed vine which, after growing over the sides, hangs down against the sides of the pillar.

Another beautiful type of pillar flower box is shown in the fifth view. This is one of the very latest holders to make an appearance in Southern California. It continues entirely around the pillar. While the pillar is "shaked," as is the exterior of the home, the holder is of plain material. It is eight inches square, furnishing plenty of room for the growing of many kinds of pretty vines.

Another novelty in the way of a pillar flower holder is shown in the sixth illustration. This consists of a two-inch indentation in the side of the pillar, beneath which is a 10-inch shelf and upon which the flower pot is placed.

In the eighth view is seen a flower holder left in the top of a short pillar. This holder is twelve inches in diameter and a foot deep, and is surmounted by four porch pillars.

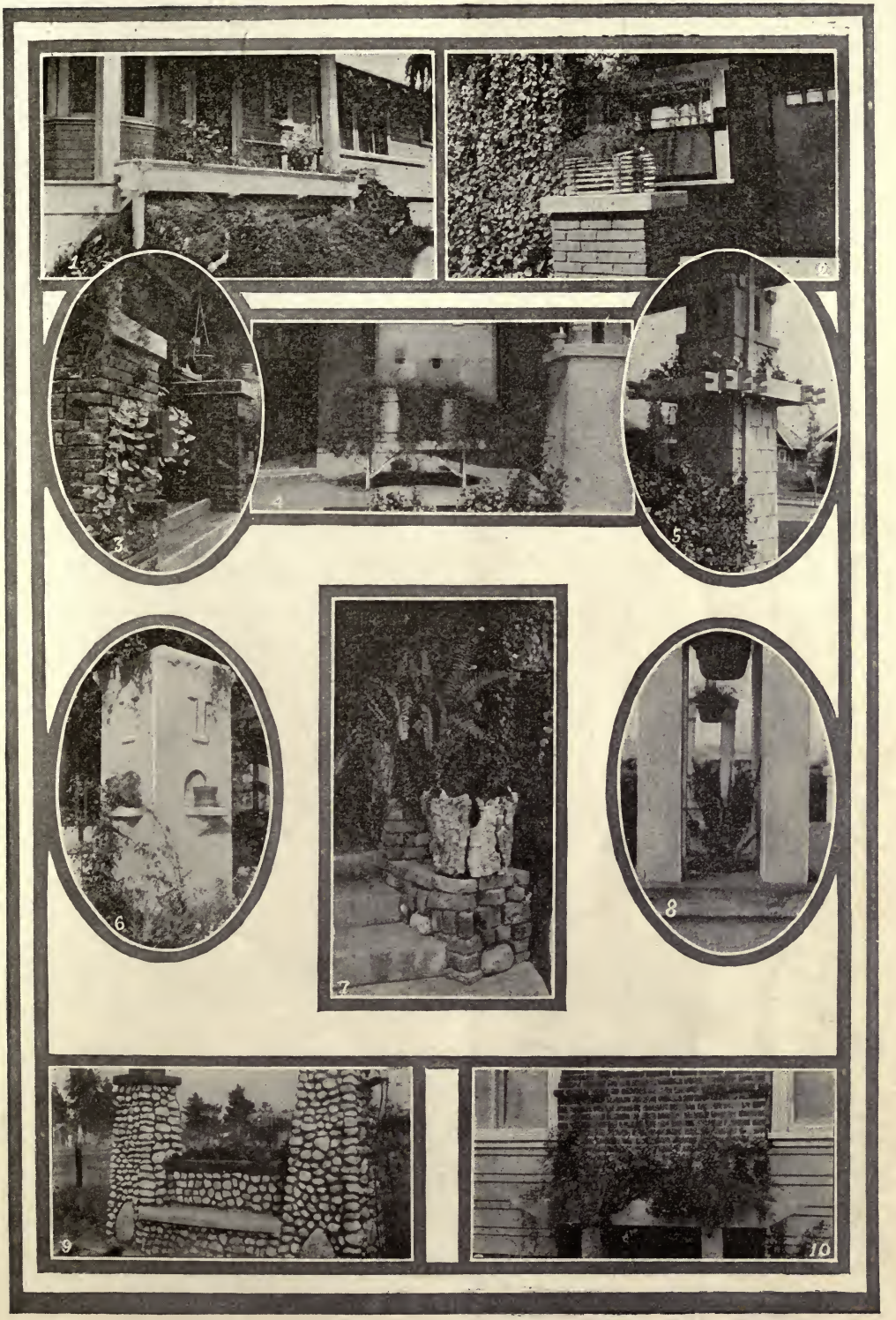
A pretty flower box for the beautifying of the chimney is shown in the tenth illustration. This box is about nine feet in length, a foot deep and twelve inches wide. The two supports are short sections of eight by eight beams. The earth is put directly into this box and in it are planted the ferns and trailing vines. This serves to break the plain lines of the chimney.

In the fourth view is demonstrated how a little foresight paid big returns. During the construction of this home the builder saved several of the empty nail kegs. After the building was completed two of these kegs were painted to match the home and now serve as fern holders upon the front porch.

That a very pretty flower holder can be made out of ordinary sticks is proven in the second picture. The material used in this holder are plain eucalyptus sticks, but when assembled in this novel manner result in an attractive home ornament.

THE VIEWS APPEARING ON THE OPPOSITE PAGE ARE AS FOLLOWS:

(1) A Wooden Flower Box Adorning a Porch; (2) Flower Box Placed on the Top of a Stair Post; (3) Flower Boxes of Different Designs which Lend Attractiveness to Bungalow Steps; (4) Two Old Kegs Being Used as Pots for Plants; (5) An Effective Flower Box Surrounding a Porch Column; (6) Shelves and Niches in Concrete Pillars, for Holding Flower Pots; (7) Flower Pots Made from the Bark of Trees; (8) An Odd Way of Placing Flower Pots Between the Porch Posts; (9) Combination Bench and Flower Box; (10) A Chimney Flower Box.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A cork bark-covered flower pot is shown in the seventh view. In truth this holder is simply a plain, round wooden box, to the outside of which these strips of bark have been tacked, resulting in a pretty and unusual flower container.

An unusual porch flower box may be seen in the first illustration. This runs entirely along one side of the porch. It is a foot square and about twelve feet in length and is made of common one-inch boards. Flowers and ferns grown on the ground beneath this box add to its attractiveness.

A RAILROAD BRIDGE CARRIED ON A BOAT

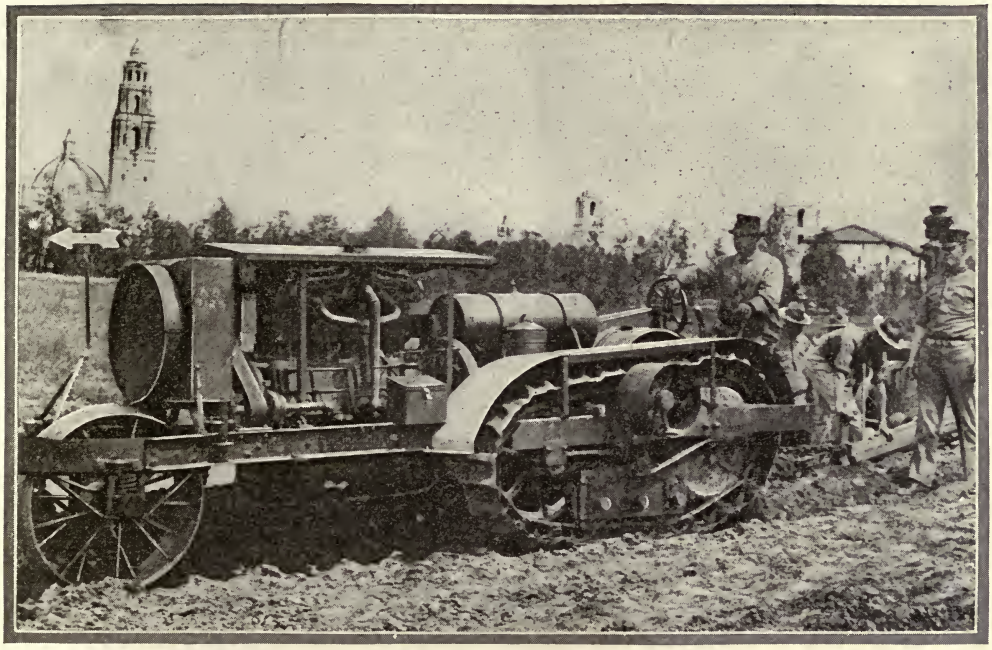
One of the notable features of a railroad bridge over the Miami Canal at Mebase, Ohio, is that the rotating end is carried on a float or pontoon when the bridge is swung.

With the canal gradually falling into disuse, a bridge was needed at this point which would be a fixed span from the standpoint of the railroad, yet capable of being converted into a drawbridge on short notice and opened to allow boats to pass.

It takes one man about half an hour to open and close the bridge, which is interlocked with electric signals to indicate to approaching trains the position of the draw. Half an hour seems a long time to hold up railroad traffic, but boats are so infrequent that the total delay to trains is more than offset by having a bridge over which trains can pass at full speed.

In opening the bridge, which is accomplished by hand, the bridge tender goes about it as follows: the rail locks, which make the rail on the bridge to all intents continuous with the rails on land, are opened. The beginning of this movement sets the electric signals to danger, or "block," as railroad men call it. The lock bars extending into recesses in the concrete abutments are pulled clear. The gate valve, which admits water into the float, is then closed. The float is unwatered by the diaphragm pump until

A Drawbridge Which is So Constructed That Trains May Pass Over it at Full Speed. It Requires One Man About Half an Hour to Open and Close the Bridge.



We are told that this is a "Machine War." So it is. Even the trenches of field fortifications, made so that a retreating army may retire to them when hard pressed, are dug by machines. This picture shows the experiment in machine trench digging carried out at the San Diego Exposition. A gasoline farm tractor was used to haul a file of sappers and digging machinery.

the girders are raised off their bearing at the movable end. The other ends of the girders are pivoted.

By means of the crank on the side of the girder the bridge is then swung by winding up on the windlass the chain which is anchored on one shore and paying out chain to anchor on opposite shore. In clearing the bridge the operations are reversed.

DIGGING ARMY TRENCHES WITH A FARM TRACTOR

A heavy farm tractor was recently borrowed from the agricultural exhibit of the San Diego Exposition and driven to the marine barracks, where in a demonstration before Vice-President Marshall and other Government officials it dragged a file of sappers. The trench which resulted formed a substantial barricade, to protect the firing line of an army. The demonstration was given to prove that the farm tractor could perform serviceably in times of war.

FIVE MILLION FEET OF LUMBER SENT ABROAD TO BUILD ARMY AEROPLANES

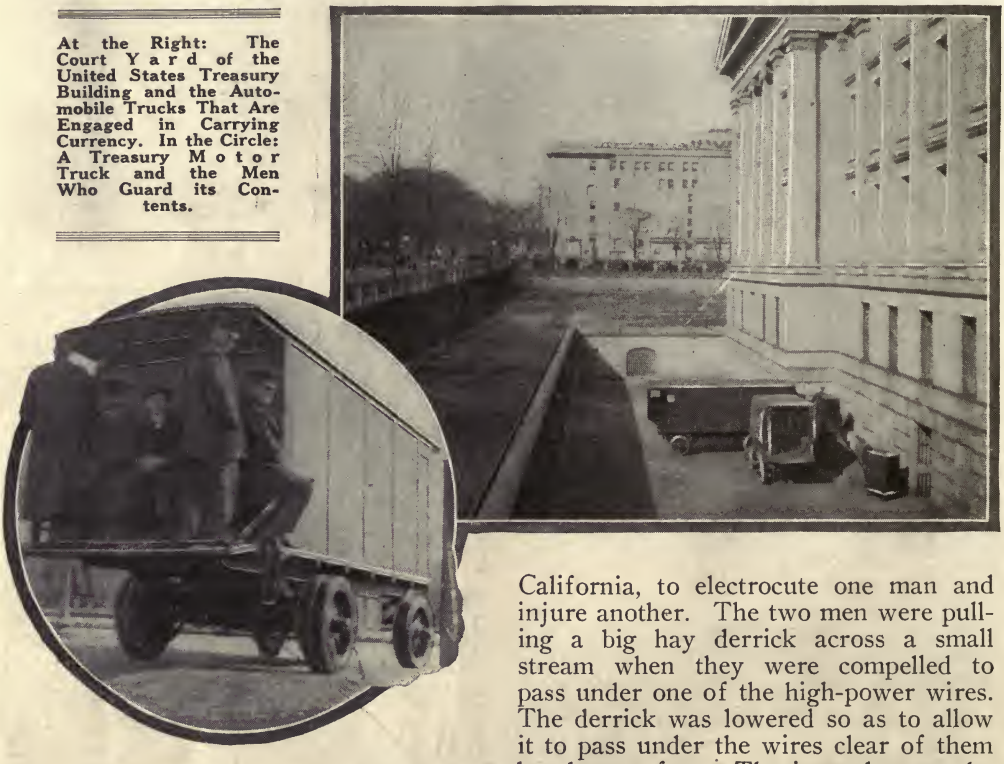
More than 5,000,000 feet of Oregon spruce have been sent to the warring nations of Europe within the last three months from Portland, for use in the making of military aeroplanes. Orders for additional amounts were not filled on account of the great scarcity of shipping space. As a result of the heavy demand, Oregon spruce has jumped from 32 to 40 dollars per thousand feet. The spruce logs have advanced from seven and one-half dollars to nine dollars per thousand feet. Great Britain has been the principal buyer to date.

It is reported from Berne, Switzerland, that in Berlin and other cities of Germany there has recently been introduced a new form of food. Consisting of flour, maize, dried vegetable and dried meat, two cents' worth of this composite food is said to be sufficient for a meal.

GUARDING A TRUCK LOAD OF CURRENCY

Three times every working day a large, enclosed motor truck of unusual length backs up to a rough wooden platform near one of the iron grated basement doors of the United States Treasury building. The doors in the rear end of the truck swing open and large yellow chests, on small trucks, are rolled out onto the platform, down an incline and into the building. In these chests is paper currency representing hundreds of thousands of dollars, the amount, of course, depending upon the denominations of the bills, which have been made at Uncle Sam's newly constructed money-making establishment down on the banks of the Potomac River. The precious load is deposited in the vaults of the Treasury building.

The trip from the Bureau of Engraving and Printing to the Treasury building is not a long one, yet on the end gate of the truck, occupying a cushioned seat provided for the purpose, may always be seen a small squad of uniformed men, whose business it is to protect this immense wealth from any hold-up men who may be lurking on the streets of Washington.



At the Right: The Court Yard of the United States Treasury Building and the Automobile Trucks That Are Engaged in Carrying Currency. In the Circle: A Treasury Motor Truck and the Men Who Guard its Contents.

A HAY DERRICK MEETS A LIVE WIRE—TWO MEN ELECTROCUTED

A small iron plate on top of a hay derrick attracted enough electric current from a high-power wire near Yuba City, California, to electrocute one man and injure another. The two men were pulling a big hay derrick across a small stream when they were compelled to pass under one of the high-power wires. The derrick was lowered so as to allow it to pass under the wires clear of them by about a foot. The iron plate on the derrick was directly under the wire when it drew the current from the naked copper. The electricity passed down the guy wire of the derrick. The man who was killed was holding one end of the guy wire and the man who was injured was holding the other end. The current carried by the transmission line outside of Yuba City is of extremely high tension, which accounts for its leaping twelve inches through the air.

SOWING THE SEEDS OF DESTRUCTION

THE "Iphigenia," one of Great Britain's many mine layers. The mines are cast into the water from the stern of the vessel by means of two adjustable gangways.

Photo. C. L. Aab.

LIFE BEHIND THE GERMAN BATTLE LINES

It is hard for an air scout to pick out his landing place or to communicate while in the air with his commanding officer. Among other devices for signalling, the Germans are using pistols that fire rockets.

The German Dogs of War. They are not savage, for theirs is a mission of mercy. They succor the wounded on the battlefield.

Entrance to officers' lodgings in a trench in France. This shelter has been built underground by the Germans and rendered shell- and water-proof by heavy masses of earth piled on its roof.

Photos. Robert H. Moulton.

SERVIAN SOLDIERS AND BRITISH GUNS

Crown Prince Alexander of Servia at the British range finder station. Admiral Troubridge of the British navy is seen in the center, observing the effect of his naval guns on the Austrian positions.

A Servian light field gun in action against the Austrians. The gun has just been fired. The camera caught it, poised in the air.

Servian infantry entrenched on platforms built within steel barges. These barges are floated down the Danube River to the Austrian positions in advance attacks.

A British naval gun which is being used in Servia to combat the Austrians. This view, as well as the others appearing on this page, confirms the report that British guns and men are aiding Servia in her war.

Photos. Copyrighted International News Service.

WITH THE ITALIANS AND AUSTRIANS

Italian infantry passing through the streets of Milan on their way to the Austrian frontier.

An Italian soldier bidding farewell to his wife and child before departure with his regiment for the front.

Serving hot soup to the Italian soldiers at one of the barracks in Italy.

In the Oval: A company of Bersaglieri on the march. The Bersaglieri are light infantry. At the Left: An Austrian armored train in the Carpathian mountains. To deceive aerial scouts, the Austrians have covered the armored cars with brush and young trees.

Photos. Copyrighted International News Service.

DESTRUCTION WROUGHT BY AN EARTHQUAKE

An earthquake that occurred in Southern California, on June 23, killed ten people and damaged along the Mexican border. It $1,000,000 worth of property shook off part of the upper story of the building.

One of the several wrecked buildings at Calexico, California, following the earthquake.

How the ice plant in the city of El Centro looked after the earthquake. Not only frame buildings, but even those built of brick were destroyed by the shock.

After the telephone building of El Centro was converted into second-hand lumber, a temporary central office was established under a tent in the streets. Despite the loss of life and property occasioned by the earthquake, the telephone girls went about their work undaunted.

Photos. Copyrighted International News Service.

THE STRUGGLE FOR THE DARDANELLES

The British battleship "Majestic" was torpedoed by a German submarine. This picture was taken just as the ship was in the act of capsizing.

Turkish artillery going to the heights along the Gallipoli Peninsula to stop the advance of the Allies.

Djemal Pasha, the Turkish general, consulting with his staff officers as to the disposition of the Ottoman forces for the purpose of halting the advance of the Allied landing forces on Gallipoli Peninsula.

A 9.5 calibre Krupp gun in the Turkish fort at Cape Helles, wrecked by the fire from the Allied fleet. Brialmont, the Belgian military engineer, who built the forts of Liége, Namur and Antwerp, designed the Dardanelles defences. He selected German guns.

Photos. Copyrighted International News Service.

MODERN WARFARE'S LATEST NOVELTIES

A French soldier using a special gun for discharging luminous balls, which are employed for lighting battlefields at night. The soldiers in the present war are called upon to fight at any hour of the day or night, and it is due to the large amount of night fighting that all kinds of light-producing devices are being used.

A new type of respirator now being used by the British soldiers to protect themselves against poison gas clouds.

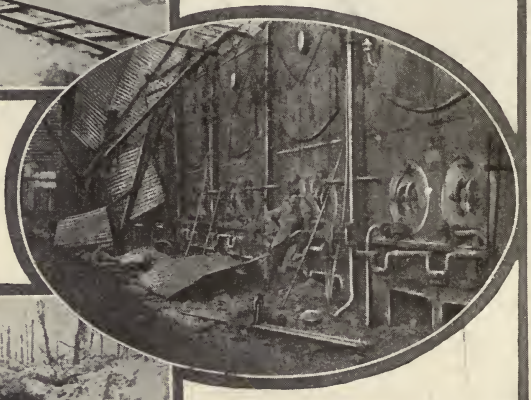
A British naval gun going to the front in Servia. This gun and several others have been dismounted from the old English warships at Malta.

French soldiers in Flanders using rifles equipped with periscopes in order not to expose their heads over the tops of the trenches.

Photos. Copyrighted International News Service.

WAR'S TOLL IN LIVES AND PROPERTY

Austrian engineering corps at work repairing a bridge that was destroyed by the Russians in their recent retreat.



The boiler room of the electric power station at Arras, showing the damage resulting from German shell fire.

French officer and priest preparing the German dead for burial immediately after an engagement in Champagne.

Another of the already too familiar scenes of destruction that mark the visit of the armies. Here is a street in the town of Ypres which has been the target of cannons for many months.

Photos. Copyrighted International News Service.

FUTURE DEFENDERS OF AMERICA

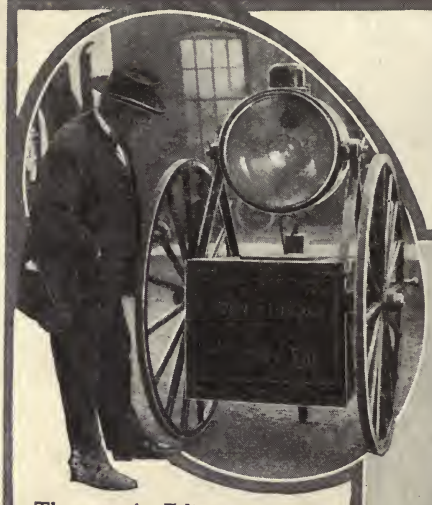
A feature of the recent annual rally and demonstration of the Greater Boston Council of the Boy Scouts of America: Having just completed a rough bridge, the troopers are safely crossing over it.

Two Boy Scouts of the Signal Corps operating a wireless station during the rally. Many of the Boy Scouts are wireless amateurs and build the apparatus which they operate. In the Oval: A Boy Scout starting a camp fire for cooking his food. This is one of the many things that are taught the Boy Scouts.

The Boy Scouts at the rally and demonstration of the Greater Boston Council, awaiting the review by Governor Walsh of Massachusetts and Mayor Higginson of Boston.

Photos. Copyrighted International News Service.

CURRENT EVENTS IN OUR OWN COUNTRY



Thomas A. Edison inspecting his latest product, a storage battery searchlight of 3,000,000 candlepower.

Below: Famous old submarine, "Holland No. 9," on a freight car at the League Island Navy Yard. It was bought by the Government in 1900 at a cost of $150,000. Instead of using the ballast tanks for submergence, this prototype employs horizontal rudders, which may be seen at its stern.

The United States superdreadnaught "Arizona" just after launching. It will be equipped with oil-burning engines.

The launching of the superdreadnaught "Arizona" at the New York Navy Yard on June 19. The "Arizona" is the sister ship of the "Pennsylvania."

Photos. Copyrighted International News Service.

CONTROLLING A FACTORY FROM SIGN BOARDS

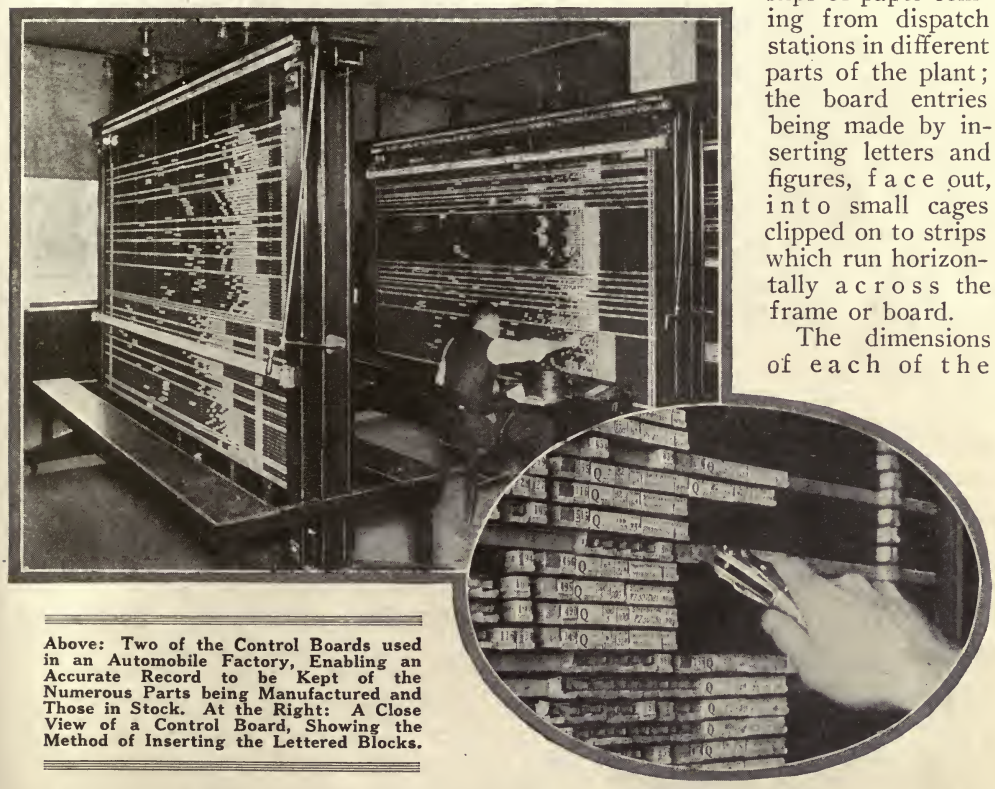
A WELL-KNOWN American automobile factory at Syracuse, N. Y., has developed a remarkable system whereby an accurate record is maintained of the thousands of parts both in stock and in process of manufacture. Thus it is possible to keep the stock within certain satisfactory limits and not have it too great or reduced to a point that may cause delay in the assembling of the cars. From a financial standpoint the system is commendable, since it eliminates the constant menace of involving large sums of money in surplus stock and labor.

The system consists of thirteen semi-mechanical boards, indicating constantly every operation in the manufacture of an automobile in the plant. A perfect time schedule is kept of over 14,000 manufacturing operations, and every step in the making of 1,300 automobile parts is directly controlled. Besides, a control is incidentally exercised over 2,500 parts in process of manufacture.

Briefness prevents a complete description of the boards, but the following essential points are of interest: The various pieces of information that are posted on the control board are secured from slips of paper coming from dispatch stations in different parts of the plant; the board entries being made by inserting letters and figures, face out, into small cages clipped on to strips which run horizontally across the frame or board.

The dimensions of each of the boards are eight by ten feet. The data is set up much in the same way as type, and the location of the type-holding cages day by day in relation to the movable production schedule, work-day measuring and calendar tapes of steel, show at a glance the exact position and volume of each factory operation.

If the production of one group of automobile parts is for any reason running behind as compared to other groups, the delay immediately becomes known and is



Above: Two of the Control Boards used in an Automobile Factory, Enabling an Accurate Record to be Kept of the Numerous Parts being Manufactured and Those in Stock. At the Right: A Close View of a Control Board, Showing the Method of Inserting the Lettered Blocks.

corrected. All specific instructions go through the control boards which make possible a perfect co-ordination of efforts leading to complicated assemblies. From raw material to finished product everything is kept moving in harmony to meet the requirements set on charts at the boards. The records on the boards are made permanent by photographs taken once each week.

Plans for building 3,500 automobiles this year mean the setting of a task involving specific instructions on about 52,000 things to be done. To check the accomplishment against the task, the accomplishment of the individual is brought back to the control board and the two compared. But since the initial instructions were exact and the methods of the factory would fail only through inaccurate orders, comparison of attainment to task is a matter principally of check to show what has been done and thus prevent duplication of orders.

As a result of the installation of the boards there has been a marked reduction in the stores and work-in-process investment in the last year and a half, although the firm is turning out twice as many cars per month.

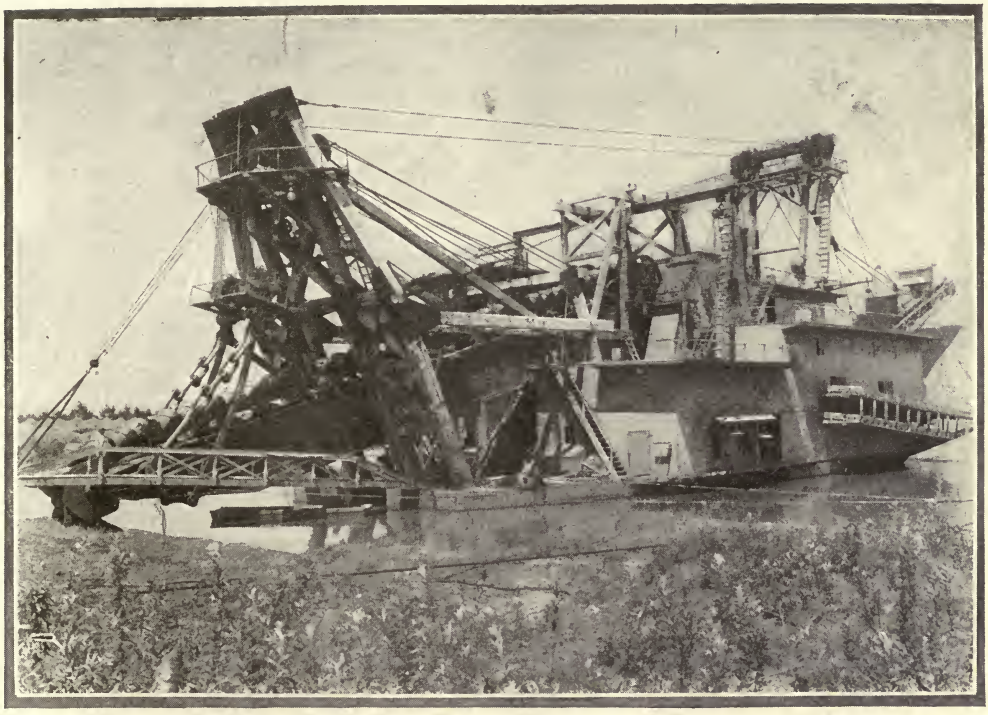
THE FOLDING BICYCLE OF THE SWEDISH ARMY

The accompanying illustration shows a useful and ingenious type of folding bicycle used in the Swedish army. There are two hinges in the frame, one in the top horizontal bar and the other in the front slanting bar directly beneath. These hinges are provided with bolts for locking them shut, so that the frame is in no danger of suddenly folding up while the bicycle is being ridden. This folding feature enables the rider to carry the bicycle on his back with ease while marching over rough roads; a leather sling being utilized for that purpose. Folding the bicycle makes it easier to carry, as the weight is more compact and not so awkward to manage. This type of bicycle enables a bicycle squad to walk closer together when dismounted and carrying their wheels over impassable roads, and also permits of packing the wheels more closely together in railway freight cars. Special apparatus for conveniently holding the knapsack is attached to the handle bars. This queer but practical army bicycle is on exhibition in the Swedish Building at the Panama-Pacific Exposition in San Francisco.

One of the Folding Bicycles used in the Swedish Army, which can be Folded and Carried on the Soldier's Back by Means of a Strap.

REDWOOD SPLINTERS MILLIONS OF YEARS OLD

The discovery of splinters millions of years old has been made by a professor of paleontology at the University of California. The splinters are neither decayed nor petrified, but retained the grain and distinct markings of the California redwood, and it is even possible to whittle shavings from the larger splinters. The discovery of these splinters was made at Mussel Rock, California, a bank of rock about twenty miles out of San Francisco. This stratum of rock offers an excellent opportunity for the study of rock formations, and it was while on a trip of this kind that the splinters were found imbedded in the sandy base of the



Claimed to be the Largest and Most Powerful in the World, this Dredge is Being Used in California for the Recovery of Gold. The Dredge has 87 Buckets of 16 Cubic Feet Capacity Each and is Electrically Operated.

rock. Furthermore, these splinters were contained in a stratum which had sunk under the sea and had been afterward raised and turned over in a different position so that the redwood trees were in a horizontal position instead of vertical.

HOW ONE MAN IN A DAY EXCAVATES 15,000 TONS OF DIRT FOR GOLD

What is claimed to be the largest and most powerful dredge that has ever been built is operating at Marysville, California. The dredge weighs 2,000 tons and cost $360,000. It is used in the recovery of gold, digging seventy feet below the water level and extracting gold from 15,000 tons of material in a twenty-four-hour day. The gold is recovered and the refuse stacked out of the way for two cents per ton.

The dredge has 87 buckets, each of 16 cubic feet capacity and weighing 4,600 pounds each. These buckets continually eat into the bank before the dredge, scraping clean the surface of the soft bed rock covered with gold particles. They then carry the gravel to a revolving screen where the fine particles—among which is the gold—are separated from the heavy gravel and boulders and passed on to a gold-saving table. Here the gold is retained by mercury and the refuse passes off. The dredge is run by electricity; a 400-horsepower motor being used to drive the bucket line. Three men on each of the three eight-hour shifts run the dredge, and so excellently is it designed that one man handles all the movements.

The labor of the great number of prisoners of war in Germany has been utilized in reclaiming more than 186,000 acres of marsh land in Prussia alone. Aside from this area, there is an additional 62,000 acres reclaimed by private organizations. This land is said to be available for an additional 13,000,000 bushels of oats this year.

By Nailing a Few Branches of Equal Length Around the Trunk of a Tree, Fastening Them Together with Wire, and Lining with Moss, an Attractive Tree Flower Basket is Formed.

TREE FLOWER BASKET — THE LATEST OUTDOOR ORNAMENT

A feature which has been termed "The Tree Flower Basket" is one of the latest things presented in the western part of this country for the beautifying of the home property. The owner of the home place knows that almost any kind of flower holders, if they are put to work, serve to add to the appearance of the property. Furthermore, where a novelty in the way of a flower basket, such as is seen in the accompanying illustration, is erected, it does more than merely serve to enhance the attractiveness of the place —it adds individuality to the dwelling.

Surely this feature adds the "individual" touch to the home it adorns. Altogether there are eight trees that have been treated in this manner, these running along the parkway beside this home. The idea is especially valuable when used in connection with trees that have tall, plain trunks, for the little baskets serve to break the trunk's plainness.

These baskets are simple in construction and inexpensive. A number of branches are cut in uniform length; palm branches being used in this instance, and the length being about eighteen inches. These are arranged around the tree about three inches apart and are held in position by wires run around their lower ends, fastening them tightly to the tree. A lining such as moss is then secured for the baskets, after which earth is placed in them. Flowers can then be planted in the earth. While many kinds of flowers may be grown in these baskets, vines and ferns which hang down against the side of the tree are very acceptable.

A SIDEWALK THAT BECAME A WALL

A novelty in the form of a retaining wall is disclosed in the accompanying illustration. It consists of sections of cement sidewalk. A short distance from the place where this retaining wall is located a street was ordered widened, necessitating the tearing up of the sidewalk along the strip to be altered. The property owner, being in need of a retaining wall along the side of his property, devised the unique idea of securing the sections of sidewalk and placing them in the position in which they are seen in the accompanying illustration. The sidewalk was five feet in width and each sec-

An Enterprising Property Owner has Made Good Use of Discarded Sidewalk Slabs by Using Them as a Retaining Wall.

tion was about five feet in length. The sections of cement were buried two feet in the ground, thus leaving three feet of the wall exposed to view.

The unique wall stands up alone, there being nothing to reënforce it. The points where the sections meet are not even cemented together. Without having cost the owner a cent, this feature serves the purpose of an expensive retaining wall.

AN AUTOMOBILE THAT TRIED TO TRAVEL UNDERGROUND

The latest method of travel to be inaugurated is that of automobiling underground—at least a large touring car recently tried to establish an underground travel era, and not through a hole in the ground either.

Two Views of a Strange Accident that Befell a Powerful Touring Car. Although the Automobile Made a Large Hole in the Ground, the Only Damage it Sustained was in the Form of a Bent Front Axle and Damaged Front Mud Guards.

The automobile in question attempted to dig its way underground, occupants and all, but through lack of strength it failed, as the illustration shows. No one was injured by the accident, and after the automobile was pulled out of the hole it was learned that no more damage had been incurred than the bending of the front mud guards and front axle.

$40,000: THE PRICE OF A STRAIGHT LINE

It is very difficult to make a perfect straight edge. We think a ruler has a straight edge, or that the edge of a knife or table or stone is absolutely straight, but they are far from it.

One of the most difficult problems in practical mechanics is to make a straight edge. How difficult it is may be judged from an incident that occurred in the shop of a celebrated astronomical instrument maker.

A patron asked what would be the price of "a perfect straight edge of glass thirty-six inches long."

"It cannot be made perfect," said the instrument maker, "but it could probably be made with a limit of error amounting to only a fraction of a wave length of light."

"How much would that cost?"

"About $40,000."

It turned out that the customer wanted the straight edge for a scraper and that

an error of one sixty-four thousandth of an inch would not bother him.

A MEMORIAL IN THE SKY TO AVIATORS

The citizens of Mill Valley, a town at the foot of the famous Mount Tamalpais which overlooks San Francisco Bay, have chosen a novel place to locate a memorial to the nation's heroes of the air. On Decoration Day they unveiled a gigantic monument to the airmen at a point three thousand feet above the place where Beachey, the dare-devil bird-man, recently met his death.

A MILKMAN AND HIS SPIRAL CAN SLIDE

The spiral can slide is one of the latest features invented for use in connection with creameries. It is used to convey empty cans from the third floor of a creamery to the ground floor. The cans are conveyed from the truck by elevator to the third floor, where they are emptied and placed upon the upper end of this slide. When the entire truckload of cans are upon the slide the trap door is opened and the cans naturally start down the chute, which is provided with steel tracks and guide rails. At the bottom the cans run upon a long platform, from which they are taken by the employee who a few moments before loaded them upon the elevator

It takes but five or six minutes for these cans to make the return trip from the truck to the third floor and back. This spiral slide is thirty feet in height and about twelve feet wide.

Much Time in the Handling of Milk Cans is Effected with the Use of a Spiral Can Slide.

MINIATURE SCENIC RAILWAY WITH CARS CARRYING NUTS

Designed to show the ability of the boys in the mechanical department of the Kern County (California) High School and to present the various kinds of nuts raised in the county in a novel and pleasing manner, the miniature scenic railway operated as a part of the exhibit of that county in the California Building at the San Francisco Exposition affords much amusement to visitors. The entire structure stands 10½ feet high and is made of strap iron and bolts, while the decorations are formed of the different kinds of nuts grown in the county, walnuts, peanuts, almonds and pecans, while the three cars which are operated upon the track are also loaded with nuts. A small electric motor operates the lifting device, consisting of a chain drive, which pulls the cars up the steep incline. In the accompanying photograph one of the loaded cars is shown just at the top of the incline, while another is seen on the dip in the second circle of track.

The Indians living near the celebrated Messa Verde in southwestern Colorado have predicted that the Government telephone line through that section will be destroyed. The Indians believe that the spirits of the ancient cliff dwellers will attack the telephone line, which passes near the deserted cave habitations.

The Deceiving Motion Picture

By Albert Marple

IT might be said that "Deception" is the middle name of the motion picture business. By this I mean that the majority of the most startling effects obtained are secured through deceptive methods. For instance, anyone who sees the heroine of a photoplay jump from the roof of a ten-story building may be sure that the fall effect is secured by unreal and ungenuine means. Then, too, if the actor appears to spring to a bridge from the stream below, or to roll, when confined within a barrel, uphill, it is easy to believe that those effects have been faked.

However, there are numerous effects that are thrown upon the motion picture screen which completely deceive the eye and convey the impression that they are genuine. There is no reason why those incidents could not have taken place just as they are projected upon the screen, and it is accordingly natural to accept them as real; although if the truth were known the ingenuity involved in producing them would be much admired.

Then, again, some of the effects that are flashed upon the curtain are generally taken to be faked, while the truth is that those particular scenes were acted out in exactly the same manner as they appear before the audience. For instance, there is an incident in "Birth of a Nation" —the multi-reel film now being exhibited in several cities of the United States to big audiences—which many will not believe is truly acted out. In one of the skirmishes an actor is seen to fall from the balcony in front of one of the residences to the ground, a distance of about twenty feet. The fall is done so recklessly that the general verdict of an audience is that a dummy has been employed. But in reality the feat was performed by a live actor who has a reputation of having fallen five miles during the past three years. Falling is his business and he seems to thrive on the severe jolts he receives.

For the greater part the faking done in motion picture producing is executed along the mechanical line, that is to say, the mechanical apparatus one sees in pictures is often unreal as is also most of the machinery. To illustrate the point, one of the accompanying illustrations shows a long and wide canvas strip on which clouds have been painted. The strip is so mounted that it can be unwound from one of the supporting rolls on to the other. This device was used for a scene depicting an aeroplane in flight. The clouds realistically flashed by the machine and to all appearances the aviator impressed the audience as being actually engaged in a flight through the

air. As a matter of fact, the aeroplane was perfectly stationary while the canvas screen in back of it was moved past. At a given signal the operator of the curtain began turning one of the spools, drawing the canvas past the machine while the scene was being photographed.

Another interesting case of deception is the building of an aeroplane for pictures. In one of the illustrations may be seen the skilled artisans of a film producing concern making a tire for a studio built aeroplane — canvas and sawdust being used for this part of the machine. The dummy machine thus produced was

The two remaining illustrations are of equal interest in the subject of motion picture deception. In one of them may be noticed a group of fake beer bottles made of papier-mache and weighing but a few ounces each. Were it not for these bottles, few actors who are struck over the head in a fight scene would really survive. In the other view a leopard skin has been sent to the property department with the request that it be stuffed at once. In such an emergency the men have had to use strong wire and excelsior, owing to the lack of other materials—but the audience will never know it.

Various Views of the Methods of Deception Practiced in Motion Picture Production. It is in the Ease with Which Striking Effects Can Be Secured by Simple Means in Motion Pictures That This Form of Drama Has Its Greatest Advantage Over the Spoken Drama.

used in a spectacular air battle scene.

Still another view shows how a stairway can be faked. The rooms are merely frames, and in this instance there is a doorway in the center of the rear. A section of stairway is placed behind this opening and as only a few steps appear within the scope of the camera, it would seem to the audience that there is a complete stairway.

DANCING AS AN ARMY EXERCISE

A recent film produced by Pathé Frères, of France, depicts the physical training of French soldiers. The film shows the usual gymnastics and fencing indulged in by the soldiers at the Joinville School and other similar institutions. Dancing has been added to the exercises.

'AS CLEAR AS A BELL

BY GEO. F. WORTS

CONGENIALITY is the prevailing climate of the Lubin system—a climate which has pervaded and nurtured every growing branch of the Lubin tree since it first began to sprout twenty years ago in the musty cellar of a little optical shop in Philadelphia. Lubin set his ideal then—moving pictures "as clear as a bell"—an ideal towards which all of his life efforts have converged.

"POP" LUBIN began his career as a moving picture king in the damp, murky cellar of a little optical shop down town in Philadelphia. Let me explain before continuing that the title "Pop" is by no means an irreverence: it is an affectionate addition which has grown upon his name as the result of a consistently congenial attitude towards his workers — and this in spite of the vise-like grip he has upon the most infinite details of the Lubin machine. Congeniality is the prevailing atmosphere throughout the entire Lubin system—an interesting feature which will be dwelt upon more fully later.

Genius in the Cellar

The first Lubin moving picture machine was inspired by a keen, far-sighted glimpse into the future, based upon a genius's knowledge of optics—and odds and ends found in the little Philadelphia shop, which shop, for reasons more or less of sentiment, is still in existence.

Mr. Lubin devoted all of his spare time in constructing his first moving picture machine along lines decidedly his own. His ideal was a machine which would avoid the glaring faults of the moving pictures of that time, namely, unclearness and unsteadiness of the projected image. In other words, he wanted his pictures to be "as clear as a bell," and towards this ideal he has worked constantly.

A Talk With Mr. Lubin

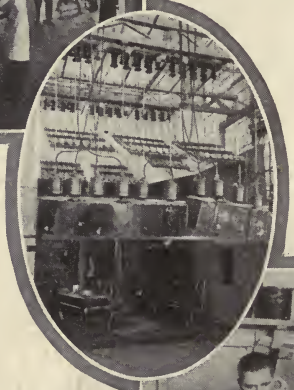
To span in a breath the twenty years intervening between then and now, the ideal, "as clear as a bell," has been completely achieved — success to which a well-flung fame amply testifies.

It is proverbial that inventors are poor business men and worse organizers. But several striking contradictions to this rule—successful inventors, keen business men as well as masterful organizers—have sprung into being with the development of today's industrial system. Edison, Marconi and Lubin are three men of this type.

Mr. Lubin's rule of success in a nutshell is to look as far into the future as

one conveniently can. He does not look back, for to look back nowadays is to turn into an industrial pillar of salt. A few years ago a valuable collection of Lubin films was destroyed by fire. This was a blow that hurt "Pop" terribly, but he was far from being crushed. He ordered ponderous underground fire-proof vaults to be built. Nothing short of a volcanic eruption can disturb these celluloid treasures now. His attitude of "looking back of the beyond" was typified in the short talk I had with Mr. Lubin. Middle-aged successful business men, especially when interviewed for a magazine, almost always fall to reminiscing. What Mr. Lubin did, however, was to grasp me firmly by the coat collar and tersely outline his big plan for the future activities of the company.

Above: A View in the Lubin Machine Shop Where the Cameras for Producing the Lubin Films Are Made. This Company Has Been Making Its Own Cameras Ever Since It Began Business.



In the Oval: A Stage Setting in the Lubin Studio. Below: A Member of the Lubin Organization Examining a Reel of Film to Determine Whether the Various Scenes Are in Proper Rotation.

"I'm going to put every good play on Broadway in moving pictures," he said, "especially comedies."

"What about your regular productions?"

"They go on as well. I'll enlarge this plant, and build a half-dozen more if necessary."

The Lubin Family System

Then he elaborated upon his plans, but not a single word about the past. In concluding he smiled genially. "While you're here, remember you're a member of the Lubin family," he said.

Every one working there is, so to speak, a twig of the Lubin family tree, a fact which holds with the more distant branches in Los Angeles, Jacksonville, Brooklyn, Betzwood, and even to Romaine Fielding's company—the Lubin nomads.

The direct result of the Lubin family system can be compacted into two words: complete co-operation. Congeniality, self-help and all those sort of things, of course, go along with it. Five minutes after I had been introduced to Ormi Hawley, the young lady who has captivated Australia, I was an "adopted son" —even if I did happen to be the two or three hundredth!

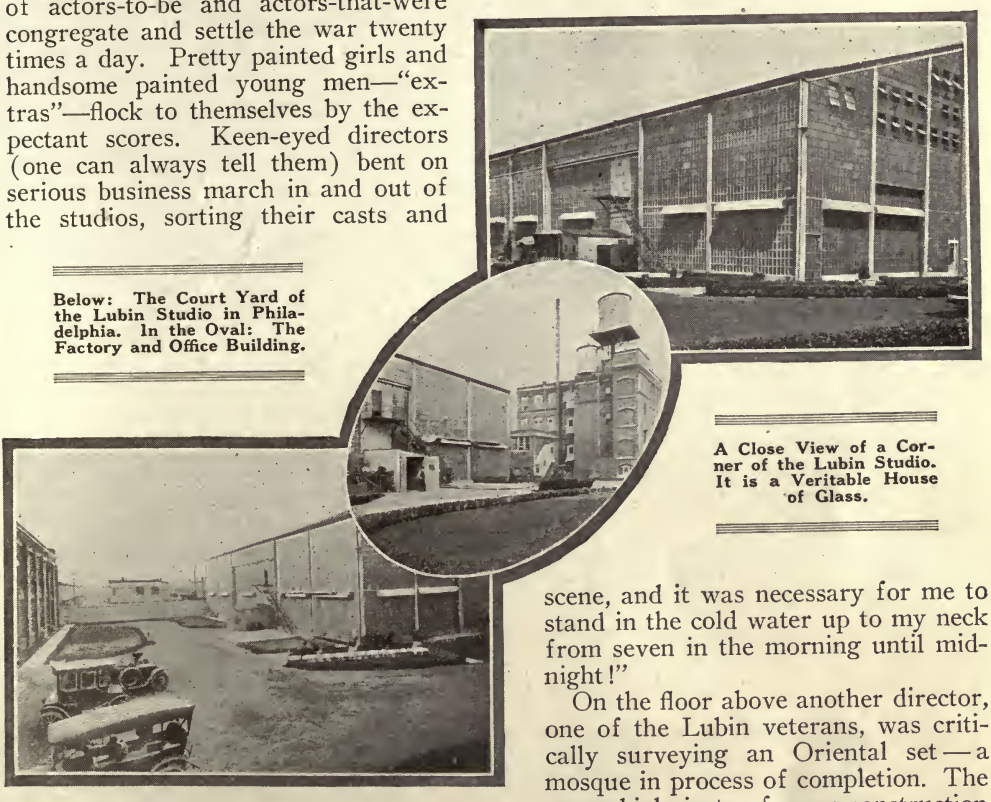
The stranger at the Lubin gates is welcomed warmly—because everybody there is proud to show what he is doing—and they have a right to be proud.

In the Lubin Courtyard

The Lubin plant in Philadelphia consists of a group of large, airy buildings surrounding an attractive court of well-kept lawns, hedges and a broad

roadway where a battery of Lubin automobiles is parked ready for service at an instant's notice.

In the courtyard little sociable groups of actors-to-be and actors-that-were congregate and settle the war twenty times a day. Pretty painted girls and handsome painted young men—"extras"—flock to themselves by the expectant scores. Keen-eyed directors (one can always tell them) bent on serious business march in and out of the studios, sorting their casts and



Below: The Court Yard of the Lubin Studio in Philadelphia. In the Oval: The Factory and Office Building.

A Close View of a Corner of the Lubin Studio. It is a Veritable House of Glass.

talking vigorously with their leads and their assistants.

The studio building—it must be remembered that the East Philadelphia factory is only a replica in miniature of the giant at Betzwood—is a sloping, crystal-covered structure of red brick. Any number of scenes go on in there continuously. A hospital ward, suggestively warlike, was being staged on the lower floor. The detailed workings of this set were courteously explained by Crane Wilbur, who was somewhat limited in his gestures by a swathing of bandage. Crane was a battle-worn hero, and he looked the part.

Bringing the World to the Studio

Beneath the floor planks of this studio, so the director in charge explained, is a large tank for staging "water stuff."

"I had one amusing experience here," said the director, smiling, "at least it seemed to amuse everybody, even if I did miss the point. We staged a mill scene, and it was necessary for me to stand in the cold water up to my neck from seven in the morning until midnight!"

On the floor above another director, one of the Lubin veterans, was critically surveying an Oriental set—a mosque in process of completion. The proverbial nicety of scene construction and design was well illustrated here. The grain of the marble—wood that had been transformed through the skill of a scene painter—would have deceived the eye of a stone cutter.

The director was a busy man, but he stopped work promptly to explain things—wherein he exemplified the usual Lubin spirit.

"We design all of our scenery to be absolutely accurate. The mosque is taken from a book on the architecture of Turkey—it is a faithful reproduction. We have a valuable collection of books covering in detail the architecture of a wide range of countries and periods. Whether we are staging a play laid in old Greece or new Ireland, we always manage to have the correct background. We cannot very well go out all over the world for local color, so we bring the

world to the studio, as you now see."

The studio was not large, as movie studios go in these days. Used scenes were shelved about the walls and in the corners. Not an inch of space was wasted.

A Miracle-Man-of-the-Movies

"We work always at top notch speed," continued the director. "Our output is a play a day, and if any contingency should arise we have enough finished reels on hand to supply the exhibitors indefinitely. Our play-a-day capacity excludes, of course, the new V-S-L-E compact (Vitagraph-Lubin-Selig and Essanay) to produce in rotation one big feature a week."

In another part of the studio building George W. Terwilliger, the Lubin director-prodigy, was directing the filming of a breakfast room scene. I mean prodigy in the sense of youth and unusual ability combined, for George Terwilliger has youth and an uncanny amount of moving picture resourcefulness. George is the kind of a man who will take pictures at random of the large fires, railroad wrecks and naval maneuvers, and then spin a heart-throb plot to fit spectacular parts.

One time he was on the ground with a cameraman during a U. S. Navy sham battle. In the back of his facile mind he had previously hatched a scenario in which a South American revolution played an important part. The way he worked the idea out, in order to combine U. S. Navy uniforms with a South American revolution, was to have his revolutionists steal several thousand U. S. Navy uniforms—and thus his flicker-story ran logically.

Nomads of the Reel

In the winter time Mr. Terwilliger Lubinizes at the Philadelphia studio, or perhaps he and his company will take a flying trip to Florida, for he is one of the Lubin's several nomads. In the summer he goes to Newport, where he directs the staging of society and navy plays—or to Cape Cod to build flicker dramas on the grounds of our Pilgrim fathers.

Perhaps the most interesting of the Lubin nomads is Romaine Fielding, who at this particular moment may be in Tasmania, the Yukon, or Chihuahua, as the spirit moves him. Fielding, like Terwilliger, writes his plays as well as directing them, while occasionally he acts.

A Scene Painter at Work Sketching the Outlines of the Scenery for a Lubin Photoplay.

Two Views in the Lubin Property Rooms. In the Above View is Seen the Large Stock of Furniture Which is Used for Furnishing Indoor Sets. In the View to the Right May Be Seen the Workmen Preparing Elaborate Statues and Panels Modeled in Clay.

Fielding has a fine sense of the artistic in scenery, and he makes it his business to search the ends of the earth for picturesque settings for his film stories. A collapsible studio is part of his equipment. Whether he is in Alaska, Japan or Somaliland, his indoor studio is always convenient.

Capturing a City to Order

During one of the numerous Mexican revolutions recently Fielding and his company attached themselves to the regular staff of one of Villa's generals. The amusing story is told of a certain attack on a city which Fielding was anxious to photograph. The general promised Fielding to make the attack in the daytime, but for strategic reasons the city was taken during the night. Fielding thereupon flew into a rage and threatened to do terrible things. So, on the following morning, the repentent general withdrew his army from the city, made the attack all over again—and Fielding got the picture he wanted! Another time he visited Mexico, Fielding needed an army to lend a punch to a play he was finishing, so, with his usual nonchalance, he calmly borrowed the entire army. It is needless to say that his personality is tremendous.

Aside from Terwilliger and Fielding, who go wherever the scenery pleases them, the Lubin has stock companies permanently installed in Brooklyn, Atlantic City, Jacksonville, Los Angeles and Betzwood. Feature plays, in which Broadway favorites appear, are produced in the Brooklyn studio; summer comedies come from Atlantic City; cowboy and Indian pictures are made at Los Angeles, while Jacksonville is the source of nearly all the comedies.

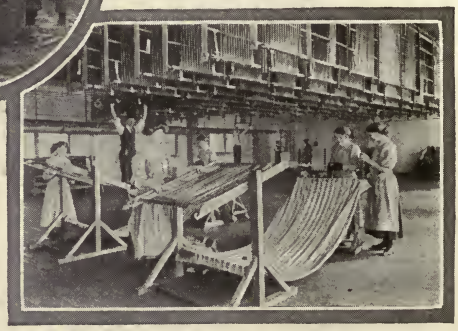
The Ranch at Betzwood

Although the main offices and some studios and a portion of the manufacturing plant are located in Philadelphia, the main plant of the Lubin is several miles from Philadelphia, at Betzwood—the Betzwood Ranch, it is called. Here highly diversified scenery makes possible almost every sort of play. In the seven hundred acres there are hills, valleys, forests, rolling plains and a river, the Schuylkill, which cuts across one corner, not to speak of ranch houses, corrals and cowboys—real ones direct from the West. Three large studio buildings and an enormous manufacturing plant with a weekly output of one and a half million feet of film comprise a productive unit in themselves. Lubin cameras, for Lubin use only, are also manufactured, and in a spacious, well-equipped laboratory

experiments are constantly in progress in an effort for a fuller realization of the Lubin ideal—moving pictures "as clear as a bell."

In a machine shop on the top floor of the administration building in Philadelphia the complicated Lubin cameras are made in small quantities, although repair work is the chief function. Film-developing and printing rooms and a projecting room occupy a large concrete building on one side of the courtyard,

Above: A Corner of the Cutting and Assembling Room Where the Various Strips of Film Comprising Different Scenes of a Photoplay Are Assembled in a Continuous Piece by Girl Workers.



In the Circle: An Incinerator in Which Discarded Film is Destroyed. Below: The Drying Room Where the Strips of Film Are Wound on Wooden Racks and Hung Up to Dry.

the scenario offices and studio flanking it on the opposite quarter.

The "Knocklodeum"

Every picture that is made in the various Lubin studios is sent by express to the headquarters at Philadelphia, where it is freely criticized by the company officials, amended perhaps, and then released to the National Board of Censorship for a final reckoning. The projection room is as large as the average moving picture theatre, and is filled with theatre seats to accommodate the directors and the company critics as well as any players who desire to view their dramatic efforts as seen by the eye of the camera. Criticism is frank and generous; not without reason, therefore, is the projection room called the "Knocklodeum."

Just to show how expensive a matter it is to make moving pictures of the spectacular sort, a number of special reels have been prepared which consist of strips or sections from the "punches" or climaxes of costly Lubin productions. There was, for example, a railroad wreck with the camera placed thrillingly close, showing two fast trains hurtling head-on into each other, telescoping and spreading in all directions. Another piece showed an old colonial mansion, especially built for the purpose, belching flames and smoke and finally burning to the ground. In others, a building was blown up by dynamite, a ship was torpedoed, a magnesium shell was exploded from the fourteen-inch gun of a dreadnaught. There were about two dozen incidents in all.

"We tried to estimate the amount of money which these punches represent," said one of the men. "But it ran so far into the hundreds of thousands that we lost count!"

The Lubin Climate of Congeniality

Harking back again to the climate of good fellowship, of sincere congeniality, which pervades the uttermost division of the Lubin system. This atmosphere is generated first of all from the dynamic personality of "Pop" Lubin himself and is taken up and re-echoed by the hundreds of workers under him. The sphere

of this influence of congeniality extends far beyond the zone of the Lubin factory, for charitableness of this kind is a fluid that gathers volume as it flows.

A number of plays for the benefit of the Belgian sufferers have been produced by Lubin talent in Philadelphia theatres. There is no recompense, yet every one gladly volunteers. Almost every charitable affair in the Quaker City finds Lubin players enrolled. Outcroppings of the Lubin spirit such as these are constantly stimulated by activities within. The Lubins have an enthusiastic baseball team and a good orchestra.

Just across the street from the factory is a little cafe popularity known there as The Madhouse, where the Lubin workers take their meals. Caste distinctions are leveled; sedate directors mingle with unemployed "extras"; leading ladies joke with waiters—everybody joins in the fun, no matter who he is. "Pop" Lubin over in one corner, who can't count his millions on all his fingers and toes, may be telling his latest story to one of the directors. Next table may be occupied by twelve-dollar-a-week scene shifters, while scattered about the room are temperamental scenario writers, sparkling leading ladies, placid cameramen and clerks, eating and drinking without a care in the world.

Our table, which was built to accommodate two, was surrounded by a dozen —Terwilliger, the Lubin miracle man; Fife, a youthful scenario editor, who wrote his way through the University of Pennsylvania; Ormi Hawley, the leading lady who has captivated Australia; a scenario writer who lives somewhere on Long Island and comes to town periodically with a batch of throbbing scripts (he had just come to town, and was blowing off steam to the extent of Champagne for the tableful); J. Allen Boone, the Publicity manager, who made a name and a fortune as a newspaper correspondent in the wake of Roosevelt's Egyptian and European tour; Mary Charleston, a lively little dare-devil of the movies, who is paid several hundred a week for jumping off precipices and swimming ice-filled rivers—and several others, equally interesting, whose names I have forgotten.

Nobody in the entire room, apparently, held himself or herself to be socially superior to anyone else in the room. Personal esteem seemed to be based entirely on one's ability to make himself agreeable—certainly not on any such undemocratic things as salary or fame.

Just why the Lubin scheme is overwhelmingly successful is, to repeat the words of the Lubin motto, "as clear as a bell," because—but why begin our story all over again?

DRILLING A CROWD TO SURGE FOR THE CAMERA

"In producing a feature," said Thomas H. Ince, the famous director who has produced several of the remarkable Mutual Masterpictures, "the crowd picture is invariably the hardest to secure. First, the important characters must be to the fore. Then again, there may be a bit of superb acting in front and some farcical stuff being parcelled out in the background. All this must come under the director's vision and the characters be so disposed as to meet the requirements of mechanics and photography.

"In 'The Sign of the Rose,' in which we starred George Beban, there is an excited, surging crowd. Here the difficulty was not with the principal players, but with those in the minor roles. For one thing, it was difficult to convince the crowd that it should be both excited and surging; it was doubly difficult to convince the policeman that he should force the crowd back just as hard as a New York copper would. It was necessary to change policemen before we found a good near-cop. The crowd rehearsed one scene twenty-four times before it reached that pitch of excitement that called for the camera man.

"All this costs money. It is part of the expenditure necessary to the production of feature pictures which have be-

come the great bulwark of the motion picture drama business. This is natural, as well as evolutional, for a feature which calls for a world of work and money. We spent $100,000 on 'The Sign of the Rose,' but we do not begrudge the expenditure, because we know we have produced something that is worth while and will repay us."

MOTION PICTURES COST $275,000,000 ANNUALLY

It is estimated by prominent motion picture producers that over $275,000,000 are being spent annually by the people of the United States for the production and maintenance of moving picture enterprises throughout the country. Few people realize that the ordinary feature-film which provides the evening's entertainment costs between $15,000 and $30,000 to produce.

Aside from the money actually spent on admissions to the shows all over the country, the greater part of the capital used in connection with the moving-picture industry is that tied up by the producers of the embryo features. Over $120,000,000 are tied up in the apparatus and property of the giant syndicates.

HOW THE WAR AFFECTED ONE FILM

"All For Old Ireland," the first of a series of made-in-Ireland comedy dramas, was finished under the greatest of difficulties last August after the outbreak of the European war. Sidney Olcott, who directed the pictures, had, the day before the declaration of war by Great Britain, taken a number of scenes on the Island of Valentia where the great cable station connecting Ireland with America is located.

Not having finished the required number of scenes, Olcott and his company returned from Killarney to the island the day war was declared, and found the island under martial law and photography absolutely forbidden. When it is considered that a number of natives, together with a lugger, manned by captain and crew, had been used, and in no way could be again secured, a serious problem confronted the producer. Olcott, however, managed to find a way out of the difficulty. The scenes were finished fifty miles away without using the same people, and yet the manner of doing so defies detection even by experts. Olcott said he was not only glad, but lucky to get back with any pictures at all after the torch had been applied which set all Europe ablaze.

THE LOS ANGELES UNDERWORLD'S CONTRIBUTION TO A CHICAGO SLUM PICTURE

Chicago's famous Metropolitan Music Hall, one of the best known resorts in the country, suggested the model for the immense setting of the dive, one of the many vividly realistic scenes depicted in "Up From the Depths," the new Mutual masterpicture, screened at the Reliance studios by Director Paul Powell.

This set, measuring 150 x 50 feet, is one of the largest ever constructed solely for motion picture work. Some idea of its vastness may be gleaned from the fact that in the scene 200 persons are shown seated or dancing in the resort. To secure the proper types for this particular scene Director Powell made a careful search through the slums of Los Angeles, with the result that many denizens of the resorts were brought to the studio, specially trained, and then assigned parts in the scene. Indeed, so realistic is this setting that one would all but imagine himself or herself seated in the resort.

AN ENTHUSIASTIC RESPONSE TO A FILM CALL TO ARMS

While the Italian armies were scaling Alpine heights in their invasion of Austrian territory, over three hundred of their countrymen were having a riotous skirmish and battle around the imperial throne in Urania, temporarily located in

the Lubin studio. The battle is the big scene in "The Coming of the Kingdom," the fifteenth part of the "Road O' Strife" serial, in which the Lubin Company is featuring Crane Wilbur, Mary Charleson and Jack Standing.

When a call was sent out by the Lubin Company for Italian volunteers, Little Italy in Philadelphia responded so nobly that it was necessary to get a number of policemen to keep them in line at the studio while the best types were selected. Over three hundred of the volunteers got uniforms and joined either the army of Urania under King George Soule Spencer or that of Hervo-Alesia, the kingdom of Queen Mary Charleson. Director John Ince took charge of the two armies and directed manœuvres and battles.

The two kingdoms had a strenuous day of it and the armies charged, fought, slaughtered, retreated, and did almost everything in the fighting line excepting dig trenches and duck real bullets. The war would undoubtedly have continued indefinitely, but Queen Mary Charleson decided emphatically that she had lost all interest in Hervo-Alesia and spoiled the plans of the ambassadors, princes and others by marrying Crane Wilbur, a student and dreamer of whom she had been very fond since their meeting in the first chapter of "Road O' Strife."

MAKING UNITED STATES MARINES ACT FOR THE MOVIES

The United States marines are called on to do many queer things and perform many strange acts, but one of the most novel stunts they have had to do was that which recently took place at San Diego. The Fourth U. S. Marine Corps is located adjoining the Exposition grounds, and one of the directors of the Lubin company had a bright idea as a result. A drama was filmed on the grounds in which the most realistic of battles was fought between the soldiers and Filippino warriors, the latter being merely more soldiers from the Government post in San Diego, properly dressed, or rather undressed, and painted in most hideous

The Members of the Fourth United States Marine Corps Taking Part in the Production of an Exciting Military Photoplay.

splendor. A battalion of marines, together with cavalry and artillery, was used in making this picture, and the soldiers keenly enjoyed the charging back and forth, the volleys of "blanks," and the novelty of being ordered around by a movie man instead of their usual officers.

DYNAMITING A HOUSE TO MAKE A PICTURE

Out in Santa Barbara, California, the general public was invited recently to view the filming of a thrilling scene designed for inclusion in the four part Mutual Masterpicture, "The House of a Thousand Scandals." The production is being superintended for the American company by Director Thomas Ricketts, and plenty of action preceded the chief incident, the blowing up by dynamite of a specially constructed house. A large crowd assembled to see the explosion, and a crowd of four hundred "extras," whom Mr. Ricketts had been rehearsing for over a week, added to the picturesqueness and realism of the scene.

A MANSION BUILT TO ORDER FOR PHOTOPLAY

Plans for staging the great $20,000 All-American prize photoplay are proceeding merrily. In the hills back of Santa Barbara workmen from the American-Mutual studios are constructing an old fashioned colonial mansion and doing it under difficulties. All the building materials have to be transported on burros. In addition to the house, winding drives, walks, arbors and outbuildings have to be constructed. This prize winning scenario writer evidently had little sympathy with the troubles of the property man and chief carpenter.

According to Director Jacques Jaccard, who is producing the big serial for the North American Film Company, the location must have been sighted from an aeroplane. Mr. Jaccard, however, has to climb there, and every one concerned has to climb to keep him company. When completed the mansion will be like the home of some great duke or millionaire.

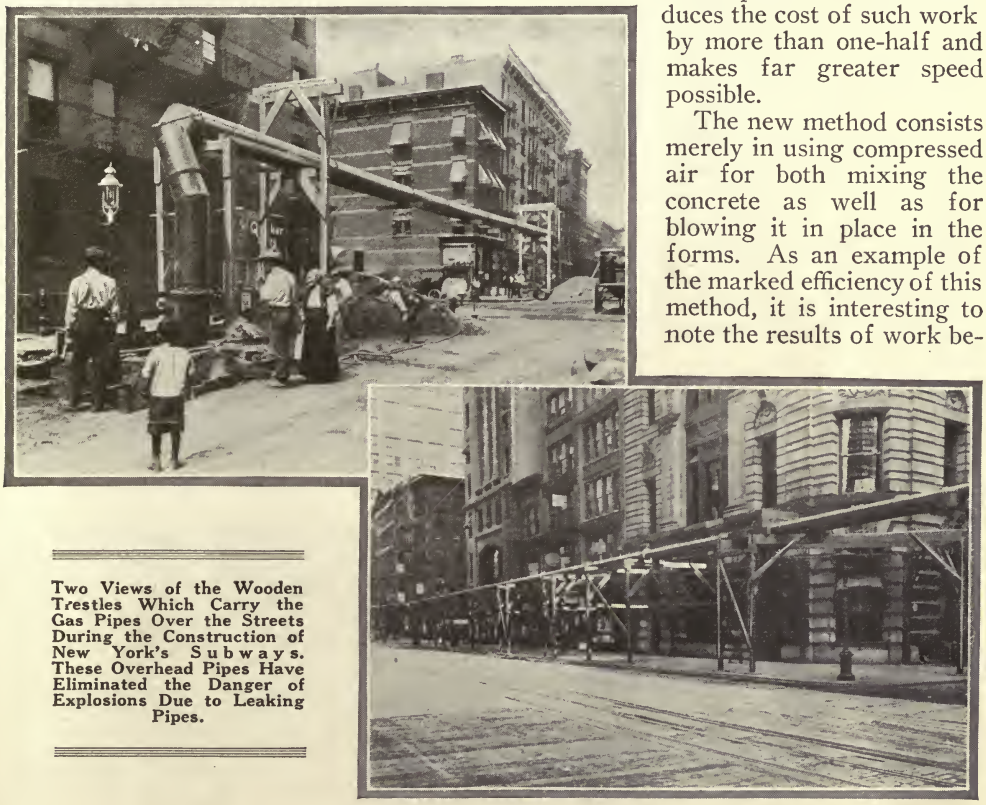
NEW YORK CITY'S ELEVATED GAS PIPES

IN many of the streets of New York where the new subways are being built, the mains of the gas companies are laid. One of the chemical properties of illuminating gas is that when mixed with an equal amount of air it forms an explosive mixture which ignites at the slightest spark, and according to the volume causes an explosion of more or less intensity. Excavations for the subways in streets carrying gas mains cannot be conducted without the danger of breaking or loosening the joints of mains, thereby allowing the gas to escape. A chance spark from one of the many underground electric wires or from the street railway would ignite such an explosive mixture, and result in serious damage. Consequently, the gas pipes, wherever the subway work is being carried on, are led above the level of the streets along structures resembling trestles or suspension bridges in miniature. This method is very similar to that used in conducting conduits along mountainsides in the west for irrigation, mining and hydro-electric purposes.

The New York "elevated pipes" are carried above the streets at a height sufficient to clear all vehicles, the average height being about twenty feet.

The neglect of other cities in diverting the gas pipes during underground work has led to serious consequences.

In Boston, for instance, during the construction of the subway in 1897, a serious explosion occurred as a result of leaking gas. Several people were killed and much property was damaged. Philadelphia had a similar experience in 1906, during the construction of the Market street subway. In neither Boston nor Philadelphia was the gas supply transferred from the underground mains to pipes laid above the ground in the open air.



Two Views of the Wooden Trestles Which Carry the Gas Pipes Over the Streets During the Construction of New York's Subways. These Overhead Pipes Have Eliminated the Danger of Explosions Due to Leaking Pipes.

In New York these gutter mains, or "by-passes," as they are called, are carried around the curb corners and back into the crosstown streets far enough to insure safety against a leakage of gas through the intervening earth and into the excavation. They are then carried across the street underground and connected to the existing mains. Where trunk mains run in the street, parallel to the excavation, they are carried on trestles built over the sidewalk.

SHOOTING CONCRETE IN PLACE WITH COMPRESSED AIR

The old method of laying concrete tunnels for sewers or railroad work involved the slow and laborious task of packing the concrete into tunnel forms by hand. Today, however, a new and clever patented method reduces the cost of such work by more than one-half and makes far greater speed possible.

The new method consists merely in using compressed air for both mixing the concrete as well as for blowing it in place in the forms. As an example of the marked efficiency of this method, it is interesting to note the results of work being undertaken at Memphis, Tenn., where two great concrete tunnels which will be employed to drain a disease-breeding bayou are now under construction. The tunnels are sixteen feet in diameter and dug by forcing steel shields through the soft dirt. As the shields move along inch by inch, the dirt is carted back. Wooden rings prevent the earth from caving in, while steel tunnel forms sustain the concrete in place until it sets. An eight-inch pipe connected with the pneumatic mixer and conveyer delivers into the form the proper proportions of sand, gravel, cement and water. A thirty-foot section is filled in three or four hours and, in view

of the fact that the concrete tube is two feet thick, this achievement may be considered remarkably fast work.

A STORE ENTRANCE BY DAY—A SHOW WINDOW BY NIGHT

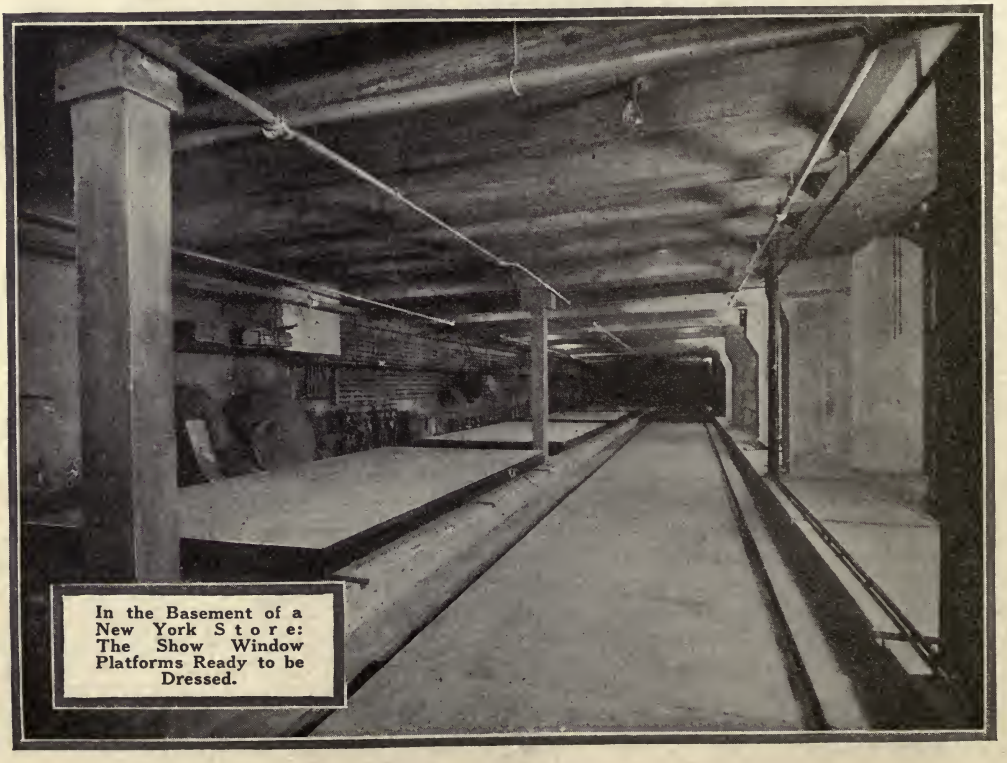
In one of New York's Fifth Avenue stores three long show windows are so constructed that they are lowered into the basement, where the window dresser may arrange his displays at leisure. They are the first hydraulic elevator show windows in existence, and represent the last word in show window advertising.

The window dresser's chamber extends under the sidewalk the entire front of the store and is illumined in the daytime by sidewalk lights. There is a trackway running the entire length of this chamber and on it is a bridge or truck which receives the window platforms mounted on rollers and carries them down the trackway to any desired window elevator, where they are moved on the elevator and raised to the show windows, level with the sidewalk above.

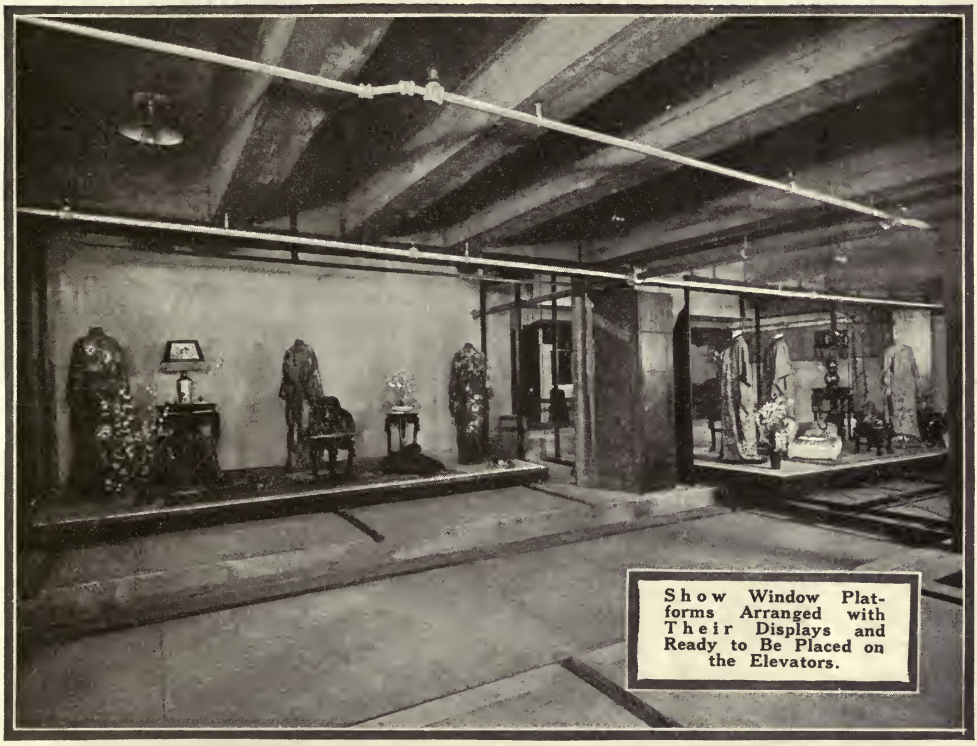
The entire set of displays may be prepared in the basement in the day time by the window dresser, and he can thus accurately gauge their effect. After he has set up a number of displays, he lowers the show cases that have been on view, shunts them out of the way, puts the new displays on the elevators and raises them to the windows. He does his work in the day time and once the displays are in position they are never changed. All other window dressers do most of their work at night.

The most remarkable feature about the elevator show window is shown in this same store. Display advertising is so valuable on Fifth Avenue that the store entrance or vestibule is actually used at night for display purposes. This is easy enough with the elevator. Persons walking by the store at night may see the floor of the vestibule or entrance begin to rise, and presently a completely dressed show window emerges.

This vestibule elevator show window



In the Basement of a New York Store: The Show Window Platforms Ready to be Dressed.



Show Window Platforms Arranged with Their Displays and Ready to Be Placed on the Elevators.

remains in this position until the avenue becomes deserted, when it is lowered to the basement. Thus a person may walk by the store and be puzzled at not finding the slightest evidence of an entrance anywhere, and return in an hour or so to see the entrance in its accustomed place. He may even walk up to it without knowing that his feet are standing on the roof of the show window, so complete is the transformation.

TURNING THE SEWERAGE TO PROFIT

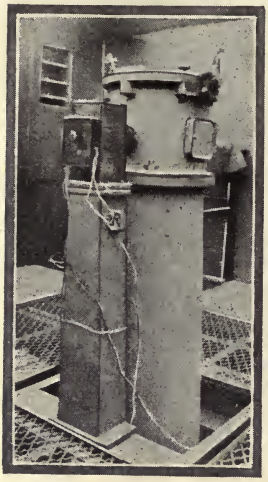
Anaheim, California, has demonstrated that a septic tank through which the sewerage of the city is passed may be turned into a source of revenue to the city instead of being a nuisance, as these tanks are supposed to be. One of the most fertile tracts of land in Southern California is a section just outside of that city, known as the "sewer farm." On the highest point of this farm is located the septic tank, and the purified water which passed through the tank has been used for several months for irrigating purposes and the resultant growth of vegetation shows that this generally expensive improvement has been turned into a source of profit.

LAKE OF WINE BURNS BLUE

A lake of wine, consisting of 1,000,000 gallons, formed a most spectacular sight when it burned blue against the blackness of the night, near Fresno, Cal. This lake was formed near the burning building of a winery, and the light blue blending with the orange tinge of the darting flames was like a huge fireworks celebration. The lake of wine extended for about a block and burned for over an hour. The loss from the burning of the winery will amount up to a half a million dollars. It was the largest in the Fresno grape district, the warehouses and fermenting rooms covering several acres. The cause of the fire is a mystery.

DETECTING AND MEASURING THE WABBLE OF THE NORTH POLE

The majority of us who look upon the North Pole as the unswerving standard of permanency will be astonished to learn that the pole "wabbles" and is not true to the central point in the heavens towards which it is supposed to be fixed.



The "Wabble" of the North Pole is Detected and Recorded by This Instrument.

The tilt of the earth was believed for many hundreds of years to remain in the same position, unaffected by its daily revolution on its axis or its whirl around the sun. But as its divergence has become a matter of record among some astronomers, the United States Naval Observatory has just finished installing a machine that will detect the polar variations with absolute accuracy. This machine, which is spoken of by the laity as the "Wabbler," has a long scientific name given it by the observatory experts. It is housed in a small building on the grounds, where tests can be taken frequently and the conduct of the pole properly watched.

The variation of the pole from the supposed straight position of its axis is a spiral course—in other words, it "wabbles" about its fixed center to a matter of sixty degrees—thirty degrees on each side. It does so just in the same manner as a top that is "dying," as the boys say, swings around from its upright position. This polar activity lasts for a space of seven years. It takes about three and a half years to spin on its outward course, then the same time to return to its point in the center. It has also been remarked by scientists that the occurrence of earthquakes is common when these polar variations are greatest. Hence the theory has been advanced that there may be some sort of connection between the "wabbling" of the pole and the earthquakes which cause such great disaster. The machine at the observatory is in charge of Dr. F. E. Ross, who will study the polar behavior with a critic's stern eye and report to Uncle Sam on its conduct.

ENGLAND'S NAVAL INVENTION BOARD

Following the example of the United States, England has formed a Naval Invention Board. Among the well-known members of the board are Crookes, Lodge and Parsons, of electrical, wireless and steam turbine fame, respectively.

BOY CHAMPION RACING DRIVER

Harry Hartz, champion junior racing driver of the world, drove over the 75-mile course of the Junior Grand Prix race at the Exposition Grounds in San Francisco in 1 hour, 36 minutes, 56¼ seconds, remarkably fast time considering the youth of the drivers, the small size of the cars and the difficult course. He had already won the Junior Vanderbilt race a short time prior to this victory, thus he is now undisputed champion. Twelve cars raced in this event for the coveted honor, and many thrilling battles for place were fought as the tiny cars whirled over the track. Young Hartz won both races in his speedy little Mercer automobile.

In a Miniature Racing Automobile the Driver, Harry Hartz, Drove Over a Seventy-five Mile Course in One Hour, 36 Minutes and 56¼ Seconds.

THE DEVELOPMENT OF AN IDEAL STEAM LOCOMOTIVE

BY ARTHUR CURRAN

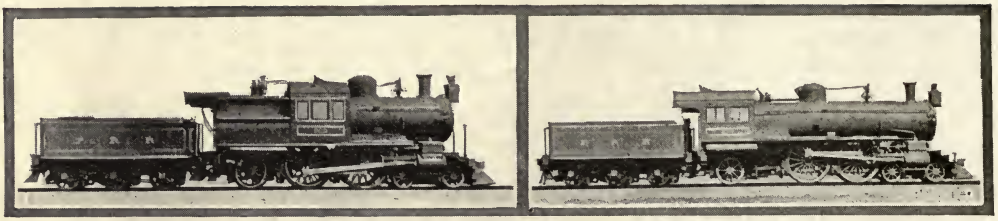
FIFTEEN years ago a leading American railroad built a locomotive which was believed most suitable for the passenger traffic at that time. But actual use pointed out many constructional features that could be improved upon; and, too, the introduction of heavier cars and longer trains necessitated the continual increase of the locomotive's pulling power and steaming capabilities. Diligently and untiringly the company labored on until there was finally evolved a most successful locomotive combining speed with power, and—what is of utmost importance—a high degree of reliability.

HOW a great railroad developed a most remarkable steam locomotive is an absorbing story to those interested in mechanical achievements, especially in view of the fact that the development has called for infinite pains in every detail and much hard and patient toil. This story is woven around the evolution of the Pennsylvania Railroad's class E-6-S locomotive handling most of the important passenger trains and which is the result of some five years' experimenting, although its origin dates back even further.

Fifteen years ago the Pennsylvania Railroad built the engine shown in the first view. This was the first locomotive of the Atlantic type to be used on that road, and included much that was common on other roads at the time, together with certain features that were identified chiefly with that railroad. The tender, however, was of the English type, mounted on six wheels after the fashion of that country. From a mechanical point of view this engine, No. 820, was a success. By reason of its "Mother Hubbard" form of construction, however, which had the effect of separating the engineer and fireman, it was not altogether satisfactory.

As a result the engine shown in the second illustration was built, with the cab in the normal location. The English tender was retained in this case, but was ultimately abandoned. With gradual modifications, this type remained standard on the Pennsylvania for a decade. When the motive power officials had reached the conclusion that this type had arrived at the limit of its possibilities, something new was decided upon.

The new idea is displayed in the seventh picture. Briefly described, this engine,



Two of the Earlier Atlantic Type Locomotives Used on the Pennsylvania Railroad. At the Left is the First Locomotive of That Design, Which Was Later Replaced by the One at the Right for the Reason That the Arrangement of Separate Cabs for Engineer and Fireman Was Found Impracticable.

No. 5075, amounted to nothing more than a big freight boiler on passenger wheels. The scheme was an instant success. The big boiler gave the engine tremendous steaming capacity, while the passenger style of wheel arrangement permitted it to run smoothly at a high rate of speed.

This engine was tested on the road and finally on the special testing machine at Altoona, as shown in the third view. Tests furnished data on horsepower, speed and other factors, which enabled the officials to arrive at accurate conclusion regarding the engine's capacity. As a result of these tests the engine was equipped with new and lighter crossheads of a special design, a new trailing truck and a superheater. It was then renumbered 1067, as shown in the fifth view.

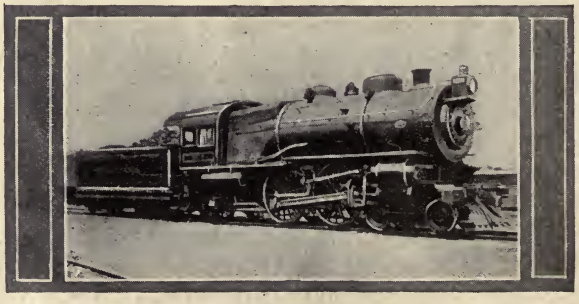
In the meantime another engine, No. 1092, illustrated in the fourth view, had been built with rotary valves. This was done in a conscientious attempt to arrive at the truth respecting various systems of steam distribution. The engine was not a success, and had to be rebuilt, but it served the purpose of showing the deficiencies of this form of construction.

The sixth picture represents one of the latest E-6-S engines. This class is very popular among engineers on account of its speed and power, and among repair inspectors because it never breaks down. The officials are interested because the engines of this class are remarkably economical.

While the foregoing-mentioned development was in progress, the Pennsylvania Railroad experimented with Prairie and Pacific types of American-built locomotives and with an Atlantic engine imported from France. Not one of these types has been able to compete successfully with the E-6-S engines on the ordinary divisions of the road.

The traffic is very exacting, owing to the crowded condition of the road and the importance of the trains that must be handled every day. High speed has been a requirement for a number of years. This will be understood when it is explained that the standard driving wheel diameter for express engines has been 80 inches for more than twenty years on the Pennsylvania Railroad. This dimension was incorporated in all the locomotives shown herewith.

The object sought in designing the latest class was a combination of speed and power. This was achieved, although every expert knows the difficulty of attaining such a desirable result. Some remarkable speed records were made years ago, but the weight of the trains involved was not great. The old-time fast engine had what, for want of a better term, may be called a genteel



The Third Atlantic Type Locomotive Used Was in Reality a Freight Engine Boiler Mounted on Passenger Engine Wheels.

job. Moreover, it was maintained with greater care than most roads wish to bestow on an engine these days.

One of the most remarkable features of the E-6-S engines is the lightness of their moving parts. This was made possible by the use of a very fine quality of steel. It will be observed that by saving weight in the construction of these parts a larger and heavier boiler could be used without exceeding the limitations as to total weight imposed by the permanent way. Even at that the weight on the driving wheels is greater than many roads could stand. It should be understood that the difference between the static and dynamic weight of an engine may be sufficiently great to wreck a track in the construction of which due allowance has not been made for such variations. The Pennsylvania permanent way is strong enough to stand this punishment, and so the new engines roar along in perfect safety.

The weight of this type, without tender, is 240,000 pounds, of which over 133,000 is on the drivers. The cylinders are 23½ x 26 inches and the boiler is 78½ inches in diameter at the first ring.

Thus far, no attempt has been made to ascertain how fast a locomotive of this class can travel. Even the most daring of the runners have not tried to investigate this point, although it is known that such engines have been permitted to exceed 80 miles per hour. It seems likely, however, that they could attain 90 miles per hour—perhaps more.

At the Right: The Third Atlantic Type Locomotive Being Tested on the Testing Machine.

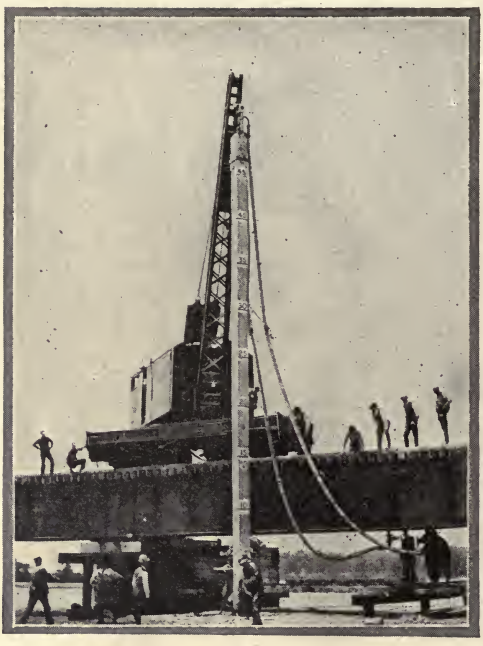
Below: The Same Locomotive After Being Equipped with New Trailing Truck and a Superheater.

Above: Atlantic Type Locomotive Fitted with Rotary Valves.

At the Left: The Present Day E-6-S Type Engine of the Pennsylvania.

FISHNETS PROTECT ROOFS

The thrifty fishermen who inhabit the coasts of England have discovered a new use for their old fishnets. During the heavy gales which blow in from the Atlantic during the winter season the fishermen are in constant fear of their straw-thatched roofs being torn away. To counteract the disastrous effects of the wind old fishnets are thrown over the roofs and their ends made fast to the stout poles which project from the eaves of the houses. As the net dries it shrinks, and the roof is held down securely.



The Many Difficulties of Pile-Driving Have Been Eliminated in This New Pile Which Bores Its Own Hole.

DRIVING A PILE WITH WATER

The difficulty of driving concrete piles into the ground with the ordinary pile driver has been eliminated in a concrete pile recently invented, which is driven by boring its own hole with a stream of water forcibly ejected at the point. An iron pipe forms the core of the pile, and water is forced through at high pressure, eroding the earth as the pile proceeds. Sand and earth are dissolved and rocks are washed away. The water pressure is 250 pounds.

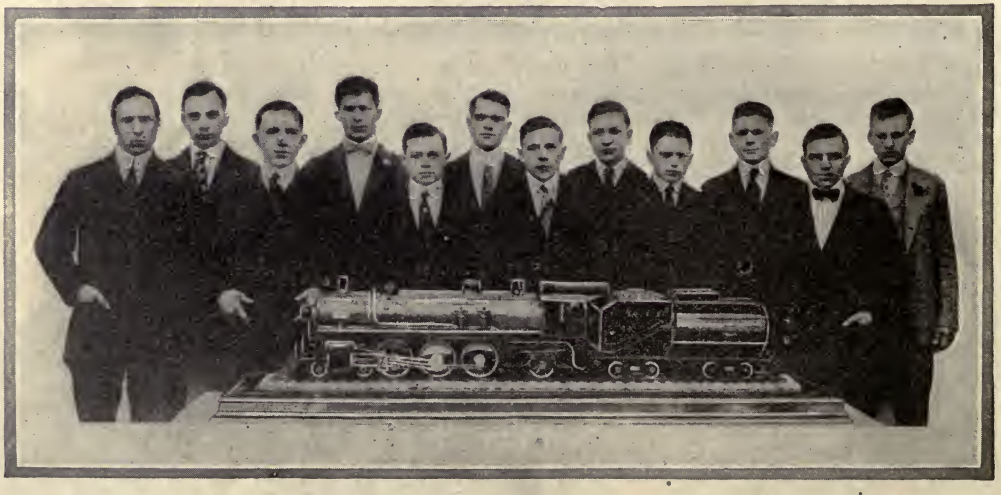
NEWTON'S GRAVITY THEORY UPSET

A California professor has made the statement that Newton's law of gravity is incorrect. After years of experiment he is now able to prove conclusively, he says, that gravitation is transmitted with the velocity of light.

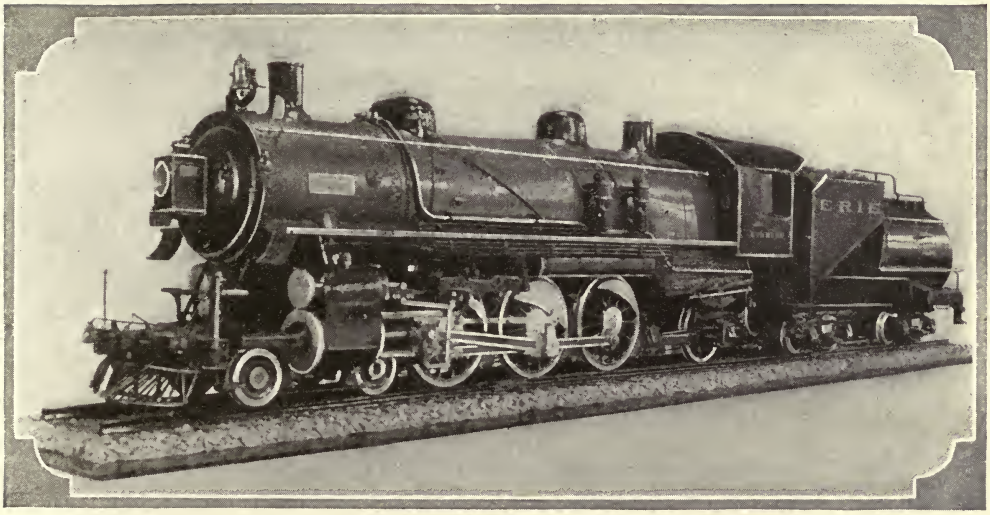
Whether or not this professor's claims are well founded, his theory is at least very interesting. Gravitation comes to the earth from the sun, according to his hypothesis, and reaches here in eight minutes.

MODEL LOCOMOTIVE BUILT BY APPRENTICES

In an effort to determine the ability of apprentice boys who were being given engine shop instruction, an eastern railroad recently put to the boys the task of building a small locomotive and a workshop. The apprentices went to work with enthusiasm. Amateur



Apprentices of the Erie Railroad Shops and the Model Locomotive Which They Constructed.



A Near View of the Model, Which Measures Fifty-seven Inches in Length and is Complete to the Minutest Detail.

draughtsmen among them quickly designed the model shop. Within a few days, both shop and locomotive were well under way. The locomotive was completed in two hundred working days. and it is perfect in every detail. It was built on a one-sixteenth scale, after the Pacific Type Class "K-4," and measures fifty-seven inches in length. It is now on exhibition in a Broadway ticket office of the Erie Railroad.

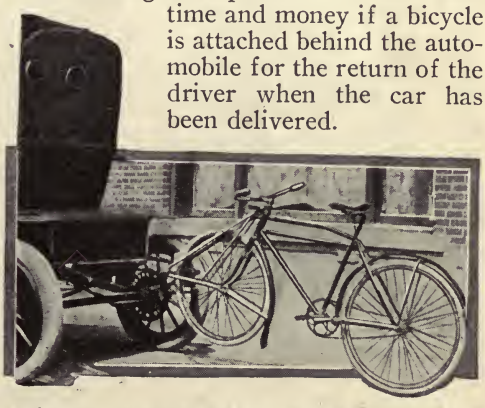
PECULIAR KIND OF GLASSES USED BY COMMANDERS OF SUBMARINES

Peculiar glasses are now being used by the commanders of German submarines. These are known as double vision glasses or bifocals and are especially adapted for use under the sea. In the undersea warfare they are very important, for they allow the officers in charge to observe hostile ships through the periscope and then consult their charts or maps without removing their glasses. The time saved in this way is very important when a torpedo is to be fired or when the submarine must make a hasty getaway. These glasses are made from a single piece of perfect ophthalmic glass, combining both distance and reading portions in one lense.

It is largely due to small details such as the glasses just described that the German submarines have proven so efficient in their deadly work.

MOTOR LEADS BICYCLE

Garage owners who make a practice of delivering their patron's cars can save time and money if a bicycle is attached behind the automobile for the return of the driver when the car has been delivered.



A Special Clamping Device Permits of Trailing a Bicycle in Back of an Automobile.

The clamp by which the bicycle is attached to the automobile consists of a pair of rubber-faced hardwood jaws and

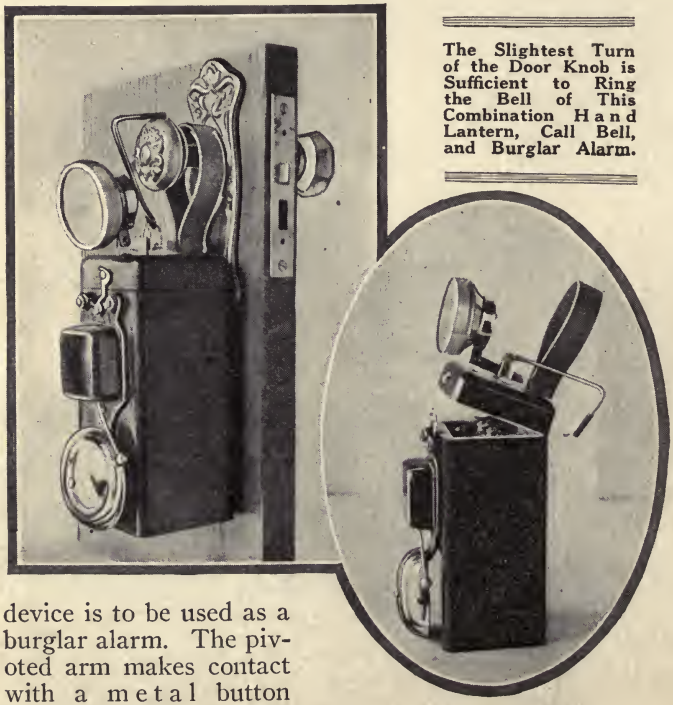
a bolt and nut for adjustments. It is held in place before the front wheel of the bicycle by two pairs of rods, one pair being fastened to the stem of the handlebars, the other to the ends of the front axle.

NOVEL BURGLAR ALARM DEVICE AND HAND LANTERN

The combination of a hand lantern, call bell, photographic ruby lamp and burglar alarm in a single device and all so arranged that in no case is efficiency sacrificed, affords an interesting example of inventive genius. In the illustration may be seen the outfit which combines these many features in a perfectly practicable manner.

On the top of the wooden container is a pivoted arm carrying at one extremity an electric lamp in a reflector and at the other end a leather strap which is slipped over the door knob when the device is to be used as a burglar alarm. The pivoted arm makes contact with a metal button when the outfit is suspended from the strap, and this contact serves to light the lamp and ring the bell. The reader will note that when the device is set the outfit is suspended from a bent rod of metal which is tipped with rubber in order that it may rest on the door knob. The slightest turn of the knob, should any one try the door, would serve to let the rod slip from the knob, thus throwing the weight of the outfit on the strap which, of course, closes the circuit. The lamp may be used independently of the bell if so desired and the reflector is arranged on a swivel, so that the light may be directed up or down as desired, without moving the entire equipment.

In replacing an exhausted battery, there are no wires to connect. A spring contact within the box makes connection the moment the cover of the case is closed.



The Slightest Turn of the Door Knob is Sufficient to Ring the Bell of This Combination Hand Lantern, Call Bell, and Burglar Alarm.

PULVERIZED COAL

With the commercial advent of pulverized coal, many engineers, who made preliminary tests with the substance, drew conclusions that it would never become an important factor in power development. At that time the remarkable ability of the internal combustion engine became known, and coal-power engines, as a whole, were given but a short period of life. Investigations have proved, however, that coal as a power factor will live for many years to come, at least in this country, as the United States contains more than half the available coal deposits in the world.

Pulverized coal has one decided advantage: It burns almost smokeless. Injecting the pulverized material into the furnace is accomplished by much simpler means, also, than with lump coal. Boiler repairs are less frequent in factories using pulverized coal than those where lump coal is employed.

SOME INTERESTING FACTS ABOUT LARGE SHELLS

One defect of large steel shells is their liability to spontaneous fracture due to severe internal strains when the steel is cooling. Modern practice in ammunition factories usually forestalls these accidents.

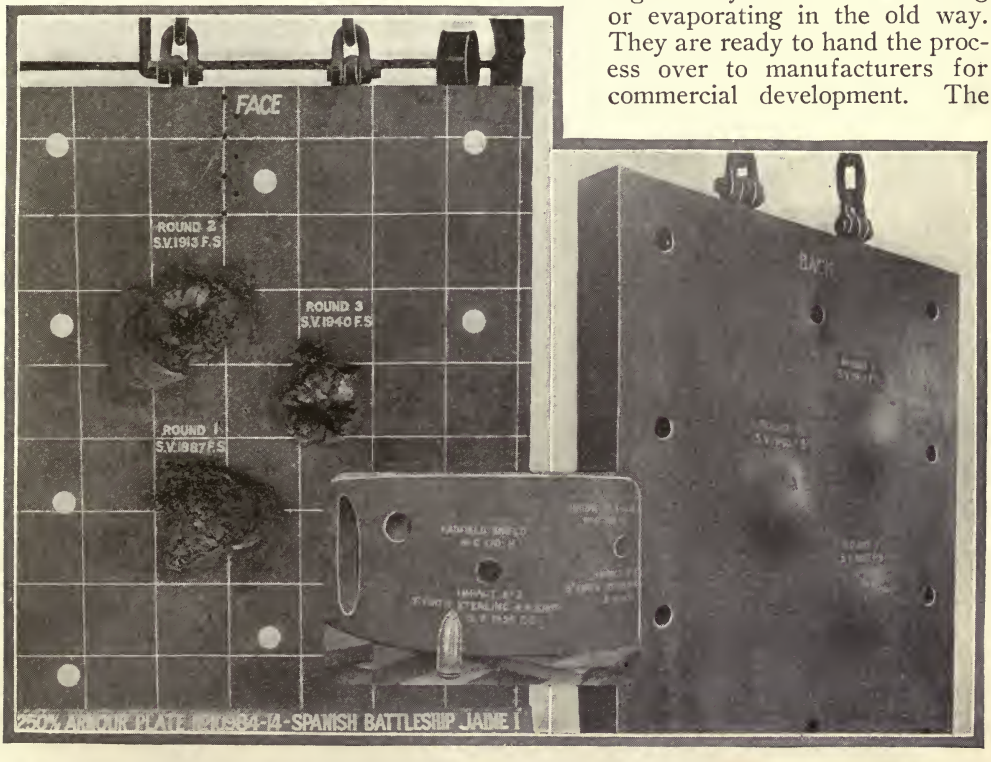
Interesting results have been secured in the Hadfield plant in England during tests of shells upon armor plate. On one occasion, a 14-inch shell, weighing nearly 1,700 pounds, perforated a 12-inch steel plate at the low velocity of 1,490 feet per second. The shell was recovered unbroken. Another shot of the same calibre was recovered, unbroken, 900 yards in front of the target. It had rebounded.

The English claim that the capped projectile has a much higher efficiency than the uncapped variety. The cap, it is said, prevents tumbling.

CONCENTRATING FRUIT JUICES BY FREEZING

Scientists of the United States Department of Agriculture have recently developed a novel process for concentrating fruit juices without boiling or evaporating in the old way. They are ready to hand the process over to manufacturers for commercial development. The products will probably be put on the market this summer.

Grape juice, or cider, for that matter, is frozen and the ice cracked into pieces the size of walnuts. These are then whirled at high velocity in a centrifugal machine such as is used in separating molasses from sugar crystals in sugar making. The syrupy portion of the grape juice is thrown out of the ice and is collected in the receiving chamber of the centrifugal. Practically nothing but frozen water is left behind. The whole separation is based on the fact that when a solution freezes the pure solvent, water in this case, tends to separate in crystals. By removing these crystals the remaining solution is concentrated.



The Effect of Modern Shells on Steel Armor Plates: At the Left is an Armor Plate of the Spanish Battleship "Jaime I," Which Was Damaged by Fourteen-Inch Shells.

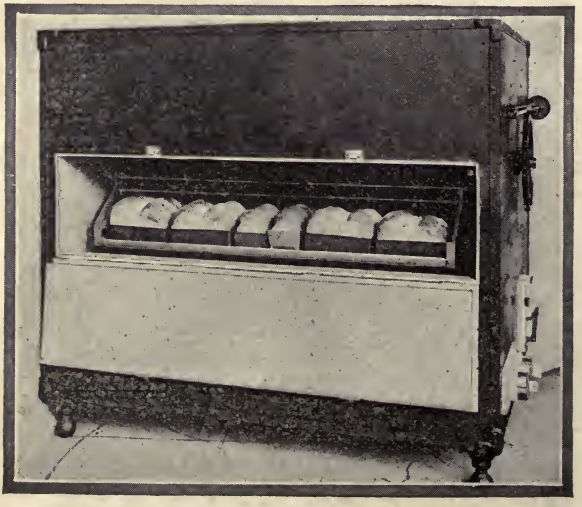
This method quickly concentrates a gallon of grape juice to one quart of syrup without impairing the flavor. To be exact, the flavor is improved because of the fact that part of the cream of tartar which gives acidity to the grape juice is left in the ice. Some juices are too acid, and this treatment improves the juice. This is notably true of the Concord grape, and in the case of the Ives grape the "rough" taste is removed.

Aside from convenience in handling, this rich syrup will save freight rates. It will be popular as a syrup for ice-cream sundaes and as a flavoring syrup in cooking. Of course, it is heated to the sterilizing point before bottling.

BAKING BREAD BY ELECTRICITY

An electric bake oven has been built for an enterprising Minneapolis baker. One of the ovens was designed for baking bread, biscuits and cake for demonstrating flour, baking powder and yeast. The current consumption is 2,400 watts for the first 45 minutes, and thereafter about 300-600 watts. The temperature is 400 to 550 degrees F.

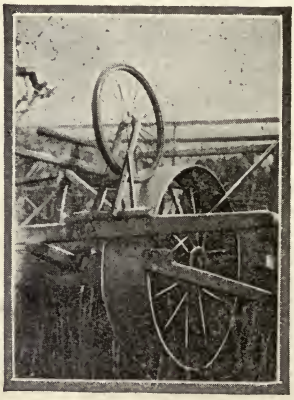
The baking oven has two-inch heat retaining walls with highly polished steel covering. The framework is of angle iron and the corners of bronze. The metal fittings are nickel plated.



An Electric Oven Designed by a Minneapolis Baker for Baking Bread, Biscuits and Cake.

CYCLOMETER MEASURES WORK OF HARVESTER

A resourceful ranch owner in Washington measures the number of miles traveled by a harvesting machine and the number of acres of grain that it cuts by using a bicycle wheel on which a cyclometer is mounted. The bicycle wheel is turned by making contact with the top of the large wheel of the harvester. When a sixteen and one-half foot swath has been cut for a distance of one-half mile, one acre has been harvested.



A Bicycle Wheel and Cyclometer Serve to Measure the Harvester's Work.

WOODEN FLAGSTAFF OVER TWO HUNDRED FEET HIGH

"The longest flagstaff produced in British Columbia will be forwarded soon to Great Britain as a present from the provincial government, and will be placed in the Kew Botanical Gardens, a few miles out from London," says a report by R. E. Mansfield, United States Consul-General at Vancouver, B. C. "The tree from which it was made was a perfect specimen of fir pine, and the staff, which is 216 feet in length, is without flaw or defect.

"In its original state the stick was 5 feet in diameter at the butt and 14 inches in diameter at the top, and perfectly straight. Dressed into shape, the staff has a diameter of 32 inches square at the butt for a distance of 16 feet. For the next 100 feet it is octagonal in shape, and for the last 100 feet it is round. The upper 200 feet has a gentle taper.

Establishing a New Gradient Record

By F. J. Dickie

EVER since railroad construction became general on the North American continent one of the most important matters to be considered when building has been the obtaining of a minimum gradient. Particularly has this been so in the case of transcontinental lines, which offered the minimum altitude. Beginning in 1903 exhaustive explorations of the Rockies were made for a period of three years. During this time four main passes, the Peace River, Pine River, Wapiti and Yellowhead were thoroughly gone over as well as half a dozen smaller intermediate ones. At the end of this time the Yellowhead Pass route was selected.

Here a maximum gradient of four-tenths of one per cent. was obtained, a rise of twenty-one feet to the mile. Considering the mountainous country passed through—

Above: A Track-Laying Machine Working Near the Summit of Yellowhead. In 1913 and 1914 This Machine Averaged Nearly Two Miles of Track Per Day. At the Right: Banks Along the Skeena River, British Columbia, Through Which the Line Was Built.

where long freight hauls on heavy grades eat enormously into the profit.

When the first coast to coast train was run recently over the Grand Trunk Pacific, the second transcontinental railway to be completed across Canada, it marked the culmination of eleven years of construction endeavor, the chief feature of which was the obtaining of a new and the lowest gradient on the North American continent.

In the obtaining of this the engineers had to find the pass across the Rockies one of the roughest in the world, where sheer cliffs hundreds of feet high had to be blasted into in order to provide a foothold for the steel—the obtaining of this grade against eastbound traffic from the Pacific Coast to Edmonton, a distance of nine hundred miles, ranks among the world's greatest engineering feats. Five-tenths of one per cent., or a rise of twenty-six feet to the mile, was obtained against westbound traffic.

Only one summit was encountered in crossing the mountains at a maximum

Supplies and Building Materials Were Shipped in Flat-Bottomed Boats While Building the Road on the Banks of the Fraser River.

altitude of 3,712 feet. These conditions, remarkable from an engineering standpoint, exist in this northern locality because the ranges of mountains along the western portion of the American continent reach their maximum altitude in the region of the 40th parallel of latitude, from which they gradually recede to the north, where the Yellowhead Pass runs through them in the region of the 54th parallel. Probably the best illustration of the varying physical conditions as met by various railroads can be shown by the following table:

Railway.	Highest summit.	Max. grade in feet per mile. Eastb.	Max. grade in feet per mile. Westb.	Total ascent in feet overcome. Eastbound.	Total ascent in feet overcome. Westbound.
Grand Trunk Pacific	3,712	21	26	6,990	6,890
Canadian Pacific	5,299	116	116	23,106	23,051
Great Northern	5,202	116	116	12,861	12,165
Northern Pacific	5,569	116	116	17,830	17,137
Southern Pacific	8,247	116	105	18,575	17,552
Western Pacific	5,712	52.8	52.8	9,385	5,076
Santa Fe System	7,510	175	185	34,003	34,506

GROWTH OF THE LIQUID AIR INDUSTRY

Liquid air is no longer a mere curiosity but a commercial product of great value. Most of it is used in making pure oxygen and in this fluid it has practically driven the older Brim's barium peroxide process to the wall. In fact, the sole competitor is the electrolysis of water, which is a rival only when the other product, hydrogen, has a ready market. The hardening or hydrogenation of liquid fats provides a limited market for this hydrogen.

The great demand for oxygen is for the oxy-acetylene blowpipe for welding and cutting metals, Germany, France and Great Britain using 300,000,000 cubic feet yearly. The possibility of another great use for oxygen was demonstrated in a Belgian steel plant just before the war. Enriching the air blast in a pig iron furnace with 21 per cent. oxygen saved 100 pounds of coke to every ton of iron and increased the output of the furnace 10 or 15 per cent. Liquid oxygen has also been used successfully in explosives.

The evaporization of liquid air separates the nitrogen and oxygen because of their different boiling points. The problem of a sale for the nitrogen has been solved. When almost pure nitrogen is passed over calcium carbide heated to 800° C., the nitrogenous fertilizer, calcium cyanamide, is formed. This is already a large industry. Nitrogen can be produced at ten or twelve cents per kilogram.

A by-product of the liquid air industry is the rare gas, neon.

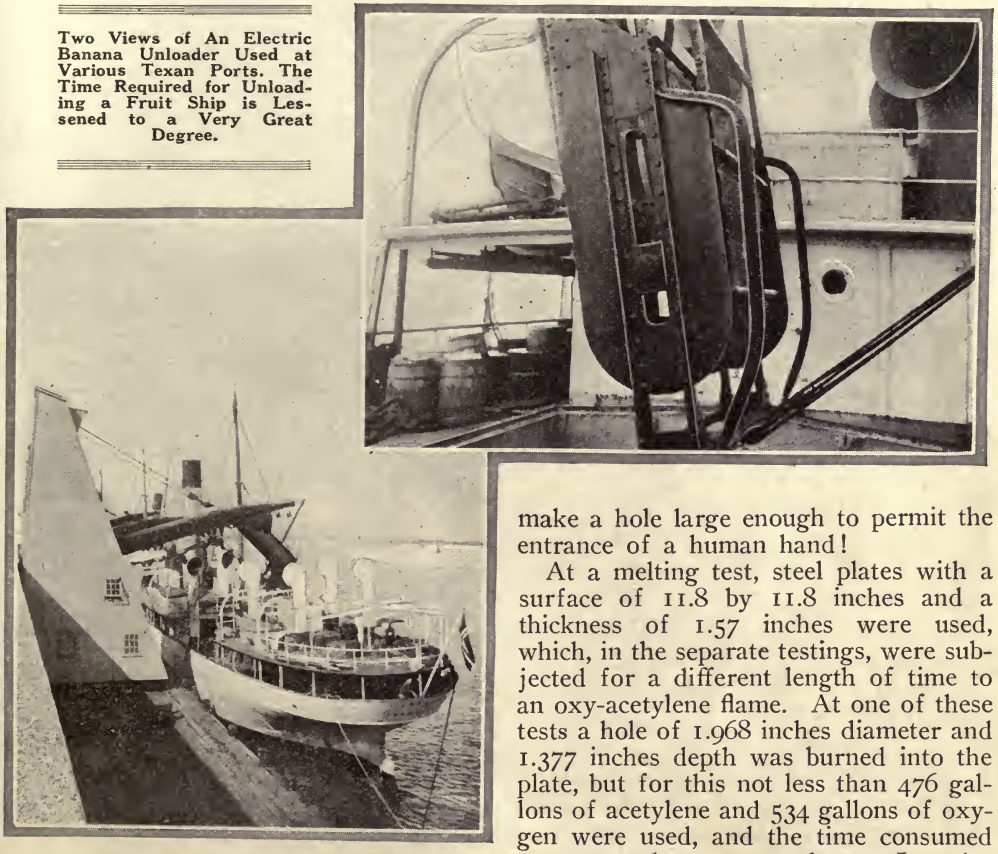
ICELAND SPAR AND LIGHT

With reference to the general subject of light transmission and pressure, the Museum of Natural History in New York maintains a room devoted to the exhibition of gems and precious stones, which room contains a plate of Iceland spar—crystallized carbonate of lime—placed just over an incandescent electric lamp. Looking down at the lamp through the spar plate, two lamps are seen burn-

ing side by side. The explanation is that the crystals of the Iceland spar are so formed that the ether contents of the plate are of two distinct densities. Thus the light attempts to penetrate either of two different elasticities. The result is the doubling of the image of the bulb as seen through the spar.

ELECTRICITY UNLOADS BANANAS

In Texas, bananas are unloaded by electricity. When the bananas arrive from tropical ports it is necessary that they reach their northern destinations as promptly as possible, to prevent them from rotting. Electric unloaders are accordingly used, as they cut to an infinitesimal fraction the time formerly required by the picturesque man with a wheelbarrow.



Two Views of An Electric Banana Unloader Used at Various Texan Ports. The Time Required for Unloading a Fruit Ship is Lessened to a Very Great Degree.

SLOW SAFE-BREAKING

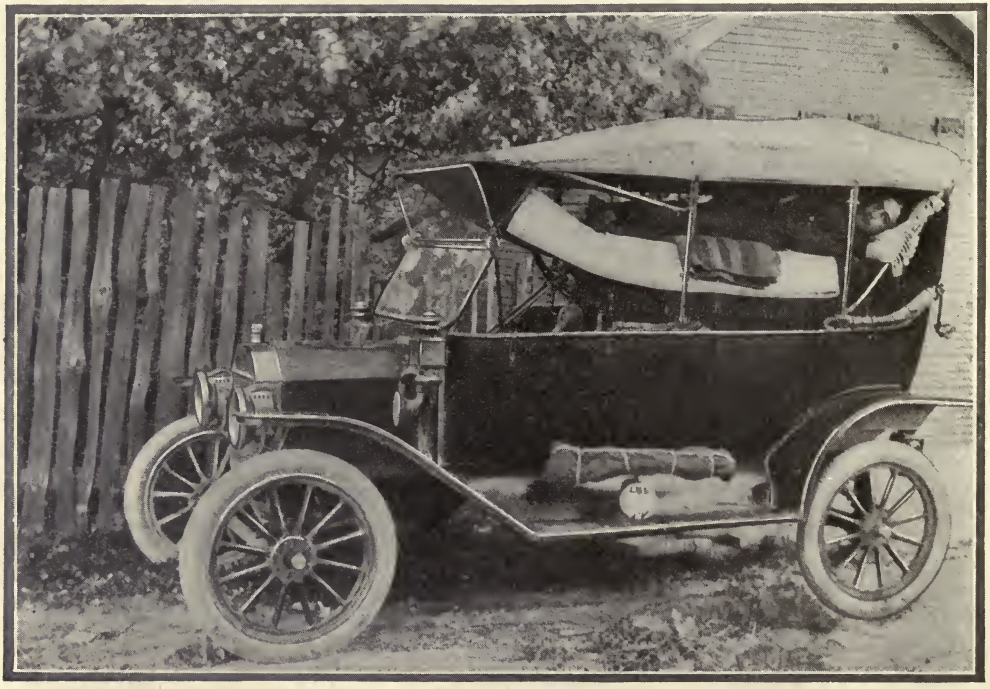
The famous firm of Krupps over in Essen, Germany, make more than "Jack Johnsons" and "Busy Berthas." They have now turned out a brand new safe which they guarantee to be burglar-proof. While this is not strictly the truth, inasmuch as burglars could break into it, the conditions necessary for getting into this safe are such that it is doubtful if one of these safes could ever be successfully burglarized.

The reason is simple enough, for while burglars can get into it with modern appliances, it would necessitate 50,200 pounds of liquid and six hours' work to make a hole large enough to permit the entrance of a human hand!

At a melting test, steel plates with a surface of 11.8 by 11.8 inches and a thickness of 1.57 inches were used, which, in the separate testings, were subjected for a different length of time to an oxy-acetylene flame. At one of these tests a hole of 1.968 inches diameter and 1.377 inches depth was burned into the plate, but for this not less than 476 gallons of acetylene and 534 gallons of oxygen were used, and the time consumed was one and one-quarter hours. In order to produce a hole large enough to admit the hand, 2,642 gallons of oxygen and 2,378 gallons of acetylene would be needed, while the performance of this work would require six hours. Conse-

quently it is clear that burglars will never succeed in melting open a safe made from the new steel, because, aside from the great outlay of time needed for this, they could not bring with them the great quantities of gas, since four steel cans weighing 154 pounds apiece would be required.

The steel plates are very hard and cannot be bored, consequently the holes for the screws and rivets must be made at the start. The new material does not lose its hardness by annealing and by reason of its tenacity can be bent to a certain degree.



No Longer Is It Necessary for Motorists to Put Up Over Night at a Hotel or Inn for a Comfortable Rest. A Washington State Inventor Finds His Automobile Bed Just as Comfortable—and Less Expensive.

CAMPING OUT IN AN AUTO

When he goes on long auto trips a Washington state inventor "camps out" in a bed swung from the top of his automobile. The bed is not merely a hammock, but utilizes the seat cushions as well. Rods, fastened over the backs of the seats and extending from the top of one seat back to the top of the other seat back, support the cushions which are taken from the seats directly beneath the bed. In this manner there is improvised a real spring bed which is roomy enough for two people. Except for the slight inconvenience of climbing into this new kind of an "upper berth," this form of camping out while on long trips involves no discomfort. The bed can be made up in from three to five minutes and when taken down is folded into a compact bundle that does not take up much room in the automobile.

A NATURAL HEATING PLANT

It is now said that hot water provides the perfect heat. The stoker of the heating plant, however, may now and then entertain the idea that there is as yet no universally perfect way of making the water hot. It is of interest to know that in at least one place on the earth Nature has been so lavishly kind as to provide and run, by her own efforts and without cost to the user, a hot water plant, and that

the inhabitants of that spot have very gladly accepted the service.

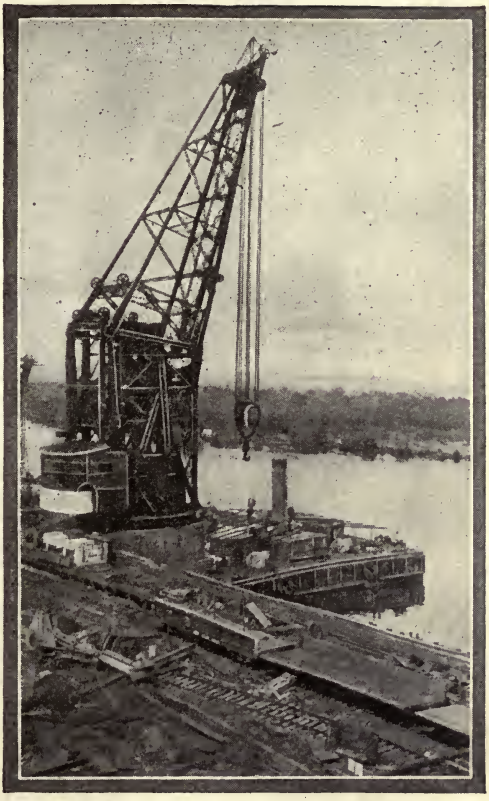
There is at Grenelle, Paris, an artesian well which provides a plentiful and constant flow of water, the temperature of which stands at something near 82 degrees F. This is a sufficiently high temperature to enable the city to make the wise and unusual use of the water above mentioned. Therefore, instead of having individual or municipal heating plants from which steam or hot water would be supplied to the various buildings or parts of the same building, the hot-flowing well is used as a central heating plant. From it pipes are run over the city, and the hot water so generously provided by the earth is distributed through them just as from the usual form of heating plant. The result is so sufficiently satisfactory that the custom bids fair to remain.

There are a number of artesian wells in various parts of the earth which provide water running to as high a temperature as eighty degrees. The temperature of the water supplied is apt to be governed by the depth of the well, the rule being that the deeper a well is bored the higher will be the temperature of its flow. The average temperature of the water flowing from these wells is not high, though it is considerably higher than that of water obtained near the surface.

The name artesian really relates to the depth of the well rather than to the taste or mineral qualities of the water obtained. The name artesian well was originally adopted as meaning a deep well. Therefore, it follows that there is really no such thing as artesian water, any kind of water being natural to an artesian well just as to any other well less deep.

GERMAN CRANE AT PANAMA CANAL

The floating crane *Hercules,* of German make, has recently been placed in commission at the Panama Canal. The *Hercules* has a lifting power of 300 tons. Some idea can be gained of the enormity of this crane by comparing its size with that of the man standing on the dock.



This Gigantic Crane of German Manufacture is Now Being Used for Mounting Guns in the Canal Zone.

The *Hercules* has been employed for mounting guns at Toro Point forts and raising machinery of various sorts which sank during a storm within the east breakwater at Coco Solo recently.

AMERICAN SUBMARINES TO UNDERTAKE LONG TRIP

In order to test the endurance capabilities of our submarines, it is announced that during the month of September the American submarines *K*-3, *K*-4, *K*-7 and *K*-8 will be sent under their own power from San Francisco to Honolulu. The journey will exceed 2,200 miles, and it is to be attempted without stops of any kind. Although there will be a convoy of submarine tenders accompanying the under-water craft, these are only to give aid in case of an emergency.

Minting in Miniature

By Oscar Lewis

IN one corner of the great exhibit palace sheltering the Departments of Mines and Metallurgy at the Panama-Pacific Exposition, there is to be found one of the most interesting of the United States Government exhibits. It is part of the display of the Treasury Department and consists of a miniature mint that is complete in every detail. There one may see and have explained to him each successive step in the minting of the Government coins, from the time that the bars of impure metal are refined by the new electrolytic process until the shining new coins pass the final inspection and are ready to go out into circulation.

To one who has never before witnessed the process, the various steps that are gone through in the minting of a coin are interesting. The metal, when it reaches the mint, is in an impure state and after being refined by means of the electric current in the new "electrolytic," as the machine is called, the pure metal is melted in an electric furnace and mixed with its alloy. Both gold and silver in their pure state are very soft, and a small amount of some harder metal must be added to them so that the completed coin will be hard enough to resist the wear that it will be subjected to when placed in circulation.

After the alloy has been added the crucible is tilted and the molten metal poured into moulds. After a moment these moulds are removed and the metal bar is cooled before being run through the rolling machine. The size of the ingots into which the metal is cast depends upon the denomination of the coins to be made from them. For double eagles, the largest gold piece that the Government mints, the ingot is slightly over a foot long by one and one-half inches wide and a half inch thick, and has a valuation of $1,488.

After passing several times through the rolling machines the bars are greatly lengthened, coming out finally over four feet long, while in thickness they have been reduced to seven-sixteenths of an inch—slightly thicker than the finished coin.

The strips of metal are now ready for delivery to the next machine where another important step in its transition from the ingot to the coin takes place. This is the automatic cutting press that grasps the strips as they are fed into the machine and draws them under a steel punch which, at the rate of eighty a minute, stamps out the round coin blanks or "plankets," as they are called. These plankets are slightly smaller and thicker than the completed coins. The perforated strips are sent back to be melted over again, while the coin blanks are inspected and weighed and then passed on to the "upsetting machine" for the next process.

In the upsetting machine the blanks are caught between two high pressure stamps which raise, or "upset," the outer protecting ridge on the edges of the coin, the purpose of which is to make the completed coins "stack" properly, and also to protect the impression on the face from wear.

The blanks are now heated, cleaned and dried—each process being carried on in a special machine—and are once more inspected before the actual striking of the impression on the coin takes place. The coining press is large and massive in construction. The oval-shaped frame is

made of solid steel and weighs several tons, for the striking of the coins is a very delicate task and must be done upon a base that is absolutely stable and rigid.

As is the case with the other machines in the miniature mint, the stamping press is automatic and runs at high speed. The blanks are put into a vertical tube at one end of the press and fed automatically to the lower die which remains stationary while the upper one descends upon it, catching the blank between the two dies as they come together. The pressure exerted amounts to 160 tons, which stamps at the same time the impressions on the two faces and the letters or etchings on the outer edge. An instant later the completed coin drops into a box below. The machine does its work at the rate of about 100 coins a minute.

After undergoing the final inspection, the new coins are weighed and then counted by being placed on an ingenious counting board which is of a certain calculated size, so that when the coins are spread evenly upon it in a single layer, the number of pieces is instantly known. Much time is thus saved, since it is unnecessary to count each coin individually. This completes the process, for the

The White Apparatus in the Foreground is the Electrolytic, or Metal Refiner. At the Extreme Right is the Electric Furnace. The Large Machine in the Center is the Rolling Mill.

The Coining Press in Which Blank Coins Are Fed to the Dies and the Impression Stamped.

At the Left May Be Seen a Machine for Polishing the Coins. The Man at the Extreme Right is Operating a Counting Board. In the Foreground is the First Coining Press Used by the American Government.

coins are now ready to be placed in circulation.

Although the coins minted at the Exposition model mint are not actual money but silver and copper souvenirs commemorating the completion of the Canal, yet they are made with the same care, methods and machinery as are found in five Government mints.

Besides the mint exhibit itself there is a supplementary display showing a complete and very valuable collection of all the coins issued at various times from the mints. The variety of these coins and the widely different designs in use during the various periods of the nation's history, make the exhibit an interesting one. A full set of the many medals that from time to time are awarded by Congress or other branches of the Government is also shown. These medals, which range in composition from bronze to gold, are all made at the several Government mints.

Another relic of rather unique interest is a crude iron hand press which was the first implement used in the coining of American currency. This press was in operation at Philadelphia for some years and with it were struck coins of various denominations until in 1793 it was superseded by more efficient equipment.

NEW SYSTEM OF LAWN SPRINKLING

A new system of lawn sprinkling in the Los Angeles parks has been installed and has already proven a great time and money saver. Water pipes are buried in the new lawns, connecting with sprinklers spaced a few feet apart so that when the water is turned on the whole lawn can be watered at one time. In this way the watering for a very large park can be attended to by one man. It has the further advantage of sprinkling a lawn more evenly than is possible by older methods.

A System of Lawn Spraying Which is Permanent: The Water is Fed to the Nozzles Through Pipes Buried Beneath the Grass.

MINUTE TELEPHONE RECEIVER

The thermaphone, an improved vest pocket edition of the telephone, is the recent invention of P. de Lange, of Holland. The United States Consul at Amsterdam, Mr. D. I. Murphy, used the contrivance and vouches for the inventor's claims.

Both receiver and transmitter can be carried in a vest pocket; in fact, they are no larger than a watch. The cost of manufacture is estimated at about thirty cents. In the thermaphone there are no magnets and diaphragm as in the telephone, but instead there is a loop of very fine platinum wire within a small aluminum cover pierced with minute holes. Electric currents passing through the wire cause changes in temperature alternating from hot to cold with great rapidity. The resulting expansion and contraction of the surrounding air becomes evident as sound.

The great advantage of the thermaphone, aside from compactness and cheapness, is its wonderful clearness of enunciation. There is no confusion of vowel sounds, letters or figures. The receiver is not more than an inch long, and no thicker than a lead pencil, so that it may be placed in the ear. This permits the use of a double receiver while the hands are left free to take notes.

POPULAR SCIENCE MONTHLY

and

THE WORLD'S ADVANCE

Good News to our Readers:

The WORLD'S ADVANCE has purchased the Popular Science Monthly, a publication of long established reputation, and beginning with the October number these two publications will be consolidated into a bigger and better magazine.

In science, in invention, in mechanics, in electricity, the greater magazine will continue to give its readers Truth, which is ever stranger than fiction, and facts which are more absorbingly interesting than fiction.

Never before in the history of our country have inventions, mechanics, electricity and all the subjects that come under the broad head of Science been of such vital interest, of such usefulness, of such importance to our country itself as right now.

More pictures, better pictures, more news of THE WORLD'S ADVANCE, more pages of reading matter than ever before will mark the future issues of this magazine.

THE EDITOR.

A WELL A MILE AND A HALF DEEP

The deepest well in the world is nearly a mile and a half deep—7,350 feet. It is in Upper Silesia, in the coal fields, and was sunk by a diamond drill. According to the United States Geological Survey, there is now being drilled in this country a well that may go deeper. It is now 7,174 feet deep, and is four miles northwest of McDonald, Pa., and about 15 miles west of Pittsburgh.

This well is being drilled until it reaches Medina standstone, which contains oil and gas. In the upper parts of the well a little oil and gas were found, and later rock salt and salt water. At a depth of 6,775 feet a temperature of 145.8 degrees Fahrenheit was met. Wells 5,000 feet deep are common in Pennsylvania.

A PINE TREE PATRIOT

Mr. Richard J. Donovan leads in a new and much needed type of patriotism —reforesting the hills of America. In the past three or four years he has planted nearly 400,000 pine trees at Pine Park in the Adirondacks. Mr. Donovan made a personal study of reforesting as carried on in Switzerland and Germany and secured expert advice from the German school of forestry and state officials. As an evidence of care in the selection of proper varieties for the soil and climate and care in planting is the fact that ninety-five per cent. of all trees planted are thriving.

Conditions in the Adirondacks, according to the school of forestry, are ideal for tree planting, especially for pine and spruce and other conifers. The cost of an acre will vary from two to seven dollars depending on the age of the trees, distance apart, soil conditions and efficiency of the tree planters.

Small trees can be purchased from the state conservation commission for from one and a half to four dollars a thousand. They are usually planted at the age of from two to four years. Seedlings cost only a dollar and a half a thousand and are easy to plant and more apt to live.

COBALT TO REPLACE NICKEL IN PLATING

The investigations of Kalmus-Harper-Savell show clearly an unexpected superiority of cobalt plating over nickel plating. The demand for cobalt has not been great and its use in plating is much to be desired. Solutions suitable for commercial practise are given below.

SOLUTION A.

Cobalt ammonium sulphate with its water of crystallization, 200 grams to the liter of water, equivalent to 145 grams of the anhydrous salt to the liter. Specific gravity is 1.053 at 15° C.

SOLUTION B.

Cobalt sulphate	312 grams
Sodium chloride	19.6 grams
Boric acid	Nearly saturated
Water	One liter

Specific gravity is 1.25 at 15° C.

Cobalt plating from these solutions on brass, iron, steel, copper, tin, lead and other metals is firm, adherent, uniform and much harder than nickel plate. These surfaces may be buffed to an excellent finish of high luster and brilliant white. The electric conductivity of these solutions is higher than that of standard nickel solutions so that cobalt may be deposited at a lower voltage for a given speed.

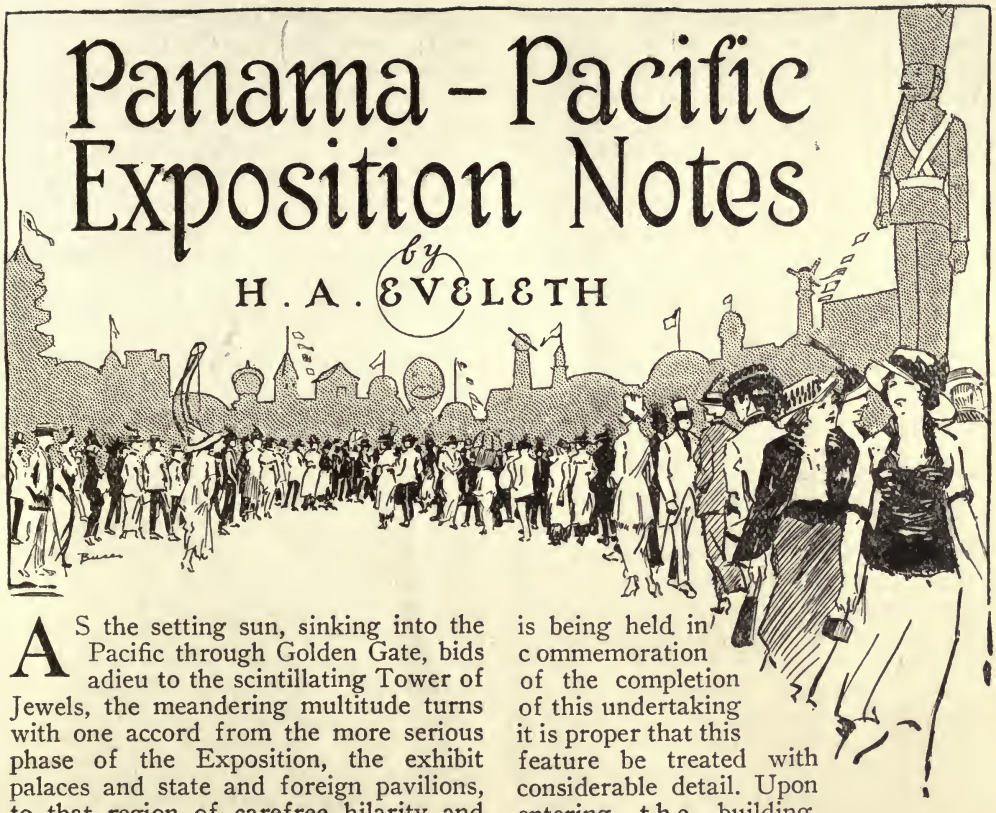
Solution *A* may be plated four times as fast as the usual nickel solutions. Solution *B*, fifteen times as fast. Cobalt deposits remarkably well in indentations of the objects plated. The high speed of deposit does not require agitation of the solutions. Since the cobalt plate is so much harder than nickel, one-fourth the weight gives the same protection as nickel. Ornamental work not subject to great wear requires only one minute deposit and fifteen minute deposits withstand great friction or atmospheric attack.

Cobalt plated skates showed far greater resistance to corrosion, wear and scratching than similar nickel plated skates. Similar results were obtained with automobile parts.

Panama-Pacific Exposition Notes

by

H. A. EVELETH



AS the setting sun, sinking into the Pacific through Golden Gate, bids adieu to the scintillating Tower of Jewels, the meandering multitude turns with one accord from the more serious phase of the Exposition, the exhibit palaces and state and foreign pavilions, to that region of carefree hilarity and fascination, known as the Zone. This district, sixty-five acres in area, is traversed by a three thousand foot road, named Amusement Street, on either side of which are located the ten million dollars' worth of amusement concessions which constitute the features of the Zone. Less than one hundred of the six thousand applications for concessions were accepted and those granted have been chosen with the most rigid selectiveness. Those admitted have conformed to a high rank of decorum, good taste and educational value, while on the other hand they have satisfied the requirements of effective fun-making and entertainment. Let us take a trip through the Zone, join the surging crowd and examine the alluring concessions which so earnestly solicit our patronage through the "spieler" with tin-horn and hullabaloo.

The Panama Canal concession is paramount among the educational attractions, and inasmuch as the Exposition is being held in commemoration of the completion of this undertaking it is proper that this feature be treated with considerable detail. Upon entering the building, wherein is located this concession, we seat ourselves upon a moving platform which is impelled by electric motors at a speed of 8½ inches per second, around the perimeter of the huge oval model of the Panama Canal and Canal Zone, which lies in a depression about 20 feet below us. A duplex telephone receiver is hanging on a hook in front of our chair and we remove it and place it over our ears that we may hear the phonographic lecture which describes the points of interest along the Canal. What a remarkable model this is! Every detail has been carried out to scale. Miniature ships travel through the locks, trains run along the tracks bordering the Canal, the illuminated buoys marking the channel flash in various colored lights, sparks leap about the miniature aerials of the radio-telegraph stations; and all this occurs without the aid of visible mechanism. The secret of this lies in the application of electromagnets which are moved about on tracks placed

beneath the model and directly underneath the route to be taken by the working model above. At the locks the steamers drop their hawsers, tow lines are magically attached to them and miniature electric locomotives tow them through the locks.

In thirty-three minutes we have completed the trip about the 1,440 foot perimeter of the model and are invited to inspect the room wherein is located the mechanism for operating the attraction. The platform or revolving auditorium encircles the model and consists of 144 cars, each ten feet long, endlessly connected. It is obvious that the lecture being delivered to a certain section of the platform must be in conformity with the position of that section in regard to the model. Hence it is necessary to divide the perimeter of the model into sections, each of which shall have a definite lecture and be so arranged that this lecture will be delivered to that section of the platform which is passing above it. To accomplish this requires a complex system of electrical mechanism. The 144 cars are divided into forty-eight sections of three cars each, and forty-eight phonographs are employed to deliver the series of fifteen lectures which are given on each trip. Space does not permit a detailed explanation of how this is done, but it is sufficient to state that each person listens to a description of that portion of the model which is directly in front of him.

The Bowls of Joy next attract our attention. We seat ourselves in a little car, are told to "Hold on tight!" then are given a shove which sends our car into the bottom of bowl number one. A revolving arm pushes us along a spiral track running around the interior of the bowl; upon reaching the top we shoot across a bridge to the top of bowl number two, where with increasing speed our car rushes downward around the spiral track and out at the bottom. We alight and then grasp the nearest post until we are able to maintain our equilibrium.

The Submarine is a $250,000.00 concession of great merit. Here we enter what purports to be a steel model of a submarine. The interior is supposed to represent that of a real underwater craft; on our right is the torpedo tube and also the depth indicator, while on the left are a number of levers and electric switches. A glass window, located in the side of the ship in front of each person, enables us to view the wonders of submarine life. At last a gong sounds, the bilge-tanks are filled and our submarine is apparently gradually submerged. For fifteen minutes we cruise about and gaze upon the peculiarities of marine life. We pass the hulks of wrecked ships, treasures scattered about on the floor of the "ocean," coral formations and Davy Jones' Locker. The fact is, we have not been submerged at all, but view the various scenes through a sheet of water, with an apparent submersion effect. The "submarine" cruise over, we are taken in hand by a guide and conducted through a series of caves, grottos and labyrinths. We pass such grotesque places as the Cave of Winds, the Valley of Mists, and Neptune's Abode. At the Love Stone our party is halted for one minute in order that any young couple present may "make love." Finally, we play the part of Jonah and enter the gaping jaws of a huge "whale." However, our host does not cough us up, as was the custom in the olden days, and we are forced to find our way out through a most intricate series of winding passages.

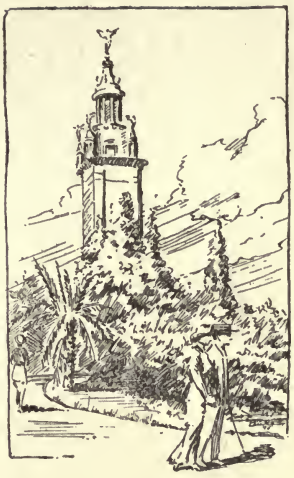
L. A. Thompson is represented by several concessions. There are the Thompson Safety Racer and the Thompson Scenic Railway, the former being equipped with block signals which remove all danger of rear-end collisions.

Toyland Grown-Up is another Thompson concession and is one of the largest

features on the Zone. We enter the Giant's Kitchen and sit down to rest on the castor of a kitchen chair. A five-foot candle is burning on the top of a thirty-foot table, while the Giant's twenty-foot hatchet stands in the corner at our right. Passing on we come to Topsy-Turvey Village, where the walls and doors and windows of the buildings are all askew and look as if some great weight had been dropped upon them. At the Midget Theatre we are entertained by a group of talented little people whose height ranges from thirty to forty inches. They present a little three-act play which is very amusing and intensely interesting. At the Flea Circus we are fascinated by the actions of trained fleas which toss miniature balls, walk the tight-rope and haul little cars around. These Human Fleas, imported from Europe, are fed on the blood of their trainer and are kept in captivity by means of fine German-silver wires looped about their necks. Four of these fleas will haul a car weighing one ounce. "King," the educated horse, understands the English language and will obey commands given by persons in the audience. Then we may take a Boat Ride or a Burro Ride, pass over Cobweb Lake and finally view the Lady Doll who is "22 years old, 32 inches high, weighs 27 pounds and speaks seven languages."

Joe's Alligator Farm, comprising a collection of turtles, rattlesnakes, pelicans, sea-cows, and five thousand alligators and crocodiles, is the next attraction. Here the oldest alligator in captivity can be seen. Jumbo Joe is his name and he is 14½ feet long, 1,800 pounds in weight and, according to the "estimates of six scientists," is 1,947 years old.

Let us take a ride in the Aeroscope and obtain a birdseye view of the Zone from a height of several hundred feet. This structure, designed by Mr. J. B. Strauss, of Chicago, lifts passengers seated in a double-deck compartment, to a height of 265 feet, makes one revolution and then returns them to the ground. The mechanism operates on the principle of the bascule bridge, weighs 700 tons, is operated by a 220 h.p. electric motor and has a cement counter-balance, weighing 380 tons. The capacity of the compartment is 118 people and water ballast is taken on automatically if the compartment is not fully loaded. The trip takes ten minutes, three and one-half of which are required to bring the structure to the near vertical.



We now pass under the colossal image of Buddha and enter Japan Beautiful. Here we are treated to exhibitions of wrestling and jiu-jitsu given by champions brought from Japan. After patronizing the Monkey Show and the Mystic Cave we pause to let Baron Scotford execute our silhouettes. A Trip to Japan gives us a good idea, by means of panoramic scenery, of the charms of that country. Then last, but not least, are the scores of ingenious games of chance which tempt us to part with our nickels and dimes.

Of course we must visit the '49 Camp, for we are promised a "good run" for our "dough," and besides, it is a "real '49 Camp, just as it used ter be with not a detail lacking." So we enter therein, pass by the Jimetown Dance Hall and the Grizzly Bear Saloon, and stop at an enclosure where we witness such scenes as "The Hold-up of the Stage," "The Robbery of the Mails" and the "Hanging of Swede Sam." Passing on we come to another enclosure where, for a small sum of money, we are given a spade and pan and are told to dig for gold; and if we have good luck we are rewarded with a real gold nugget. At the Eldorado "Klub" we may read such notices as "Come on in the dog is tied," "Leave shooting irons with Red Mike," "A piece of the rope that hung Big Foot Walace" and "Any one caut picking up a cler'er will be find the drinks." The '49 Camp is a most interesting concession, albeit

it has been closed up once for being too realistic, but then, as the "spieler" says, "This ain't supposed ter be a place for Sunday School picnics."

Passing onward we come to Tehuantepec or the Mexican Village where we are entertained with Fandango dances, given by gayly clad señoritas who gracefully whirl and dip to the accompaniment of Torreblanca's Orchestra. The selections given by this orchestra, many of the members of which are graduates of musical conservatories of Mexico City, have a charm which is best portrayed by the repeated encores from the delighted audience. The concert over, we view works of art in the line of pottery, basket making, leather and needle work, wax, cloth and feather-card work; all of which is being done right before our eyes by native artisans imported, with great difficulty, from turbulent Mexico.

Then, too, we may visit the Hawaiian Village, where we are treated by Princess Lei Lokelaui and her followers to native songs and dances, accompanied by the soft twanging strains of the ukeleles. The swarthy, sinewy, scantily-clad occupants of the Samoan Village amuse us with their Siva Siva and Head Knife dances; and in a similar manner we are entertained by the dusky occupants of the palm-shaded, thatch-roofed, Australasian Village. In the Irish Village we may take a ride in the Jaunting Cars and visit numerous other attractions which are suggestive of the shamrock.

The Freaks and Curiosities are sure to interest us. Here we gaze upon the fat lady who tips the hay scales at 617 pounds; the armless lady and armless man, both of whom are able to do with their feet those things which the ordinary person does with his hands; the man with the exposed heart; the four-legged, two-armed Filipino girl and the "elephant-skinned boy."

We may visit the Grand Canyon of Arizona, a great scenic and most faithful production built under the direction of the Santa Fé Railroad. The trip is made on a moving platform and the artificial scenery is said to give the beholder a very accurate conception of the wonder and beauty of the real Grand Canyon. Here also we may see remarkable reproductions of Pueblo and Navajo Indian Villages. The occupants have been brought from New Mexico and Arizona, and it is intensely interesting to watch them shape pottery and weave blankets and baskets; in fact their every-day life is practically the same as it was several centuries ago.

The Union Pacific Yellowstone Park concession is another great scenic production. We may dine at the Old Faithful Inn and, from the spacious veranda, gaze down upon an immense relief map of the Yellowstone Park. In the distance are great artificial mountains and waterfalls, and now and then Old Faithful bursts into action.

The "Big Four" series of concessions comprising Creation, Dayton Flood, Evolution of the Dreadnaught, and the Battle of Gettysburg are masterful productions requiring manifold electrical and mechanical contrivances, and we are thrilled by the roar of battles and tumultuous storms.

The London to the South Pole attraction is another scenic and electrical masterpiece in which we follow Captain Scott and his brave party from the time they leave London in the good ship *Terra Nova,* to the time when Scott, dying alone in his tent in the frozen South, writes a farewell message to the world, saying: " . . . these crude notes and our dead bodies must tell the tale . . . "

The Universal Motion Picture Company's concession, Filmland, is combined with the 101 Ranch Show, and thus the latter, with its troupe of Indians and cowboys, enables the filming of a large variety of scenarios. Here we may witness the taking of the motion picture, its development and finally its presentation upon the screen.

We may go slumming in the Chinese Village and see the opium smokers, the sordid life in the opium dens and the ravages of the drug upon its victims. Mr. Opium Fiend, sallow-faced and blear-eyed, lies down upon a cot, gathers some of the viscous black opium upon the end of a stick, holds it over a flame until it bubbles, places it over the end of his large tubular pipe, inhales the smoke and then falls fast asleep and has beautiful

dreams and forgets his worldly cares. Then comes the awakening; the realization that his dreams are false, and he arises in terror and reaches for his indispensable opium pipe that he may again partake of its diabolical virtues.

Then we may take a boat ride through the Old Red Mill, visit the Streets of Cairo, Eden Musee, Melodia, Dixie Land, "Our Girl's" Frolic, the Ostrich Farm, Stella, the Diving Girls, Jesters Palace, La Feria de Sevilla and Gran Plaza de Toros.

On our left, in the building near the pen of graceful storks, are housed the Incubator Babies.

"Captain," the Educated Horse, draws our admiration by his remarkable intuition of the English language and the art of reading and writing.

Of course we should patronize the Merry-Go-Round, the Picture Parlors, the Roulette Wheels and all the other whirligig contrivances which can be found in such a place as the Zone—but it is getting late; come, let us take a jitney-bus and try to catch that 2:00 a. m. ferryboat!

PARACHUTE FOR BOMBS NEW PHASE OF WARFARE

Self-propelled bombs provided with parachutes are the latest war invention. The bombs are timed so as to explode when they reach the trenches of the enemy. These bombs were invented by the Austrians and are being used extensively by their aviators. The Allies have trained sharpshooters to combat this dangerous device. These men aim to hit the bombs in mid-air, thus causing them to explode prematurely and harmlessly.

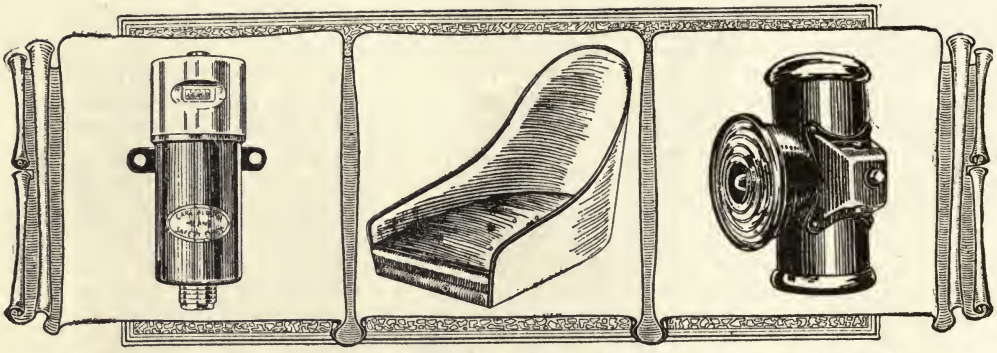
REPAIRING AN AIRSHIP'S PROPELLER IN WAR TIME

The height of boldness and fearlessness yet attained by the intrepid British air scouts was reached in the early days of the war, when the propeller of an air cruiser which was convoying a troop ship across the English Channel snapped off short and left the dirigible suspended helplessly in mid-air.

The Captain of the dirigible feared it would be necessary for his craft to descend for the repair, but two of the crew instantly volunteered to crawl out to the stern with a new propeller. Two thousand feet over the sea the helpless ship hovered, while the two mechanics crawled out upon the bracket which supports the propeller shafting. With the rest of the crew watching them in awe, the two men clambered out fearlessly and with an astounding degree of coolness attached the new blades. Passengers on steamers below watched the feat with enthusiasm, for this was the first attempt ever made to repair the broken propeller of a dirigible in mid-air.

THE MOST SOLID BOOK IN THE WORLD

Consisting of but ten pages, yet laying claim to the title of the most solid book in the world, a volume recently presented to the Columbia Field Museum is an unique work of art. It is made up of ten slabs of the finest jade, exquisitely engraved with Chinese characters. The text is in both Chinese and Manchu, with the most elaborate ornamentations on the first and last pages. This queer jade volume was made at the order of the Emperor Kang-hsi, who lived from 1662 to 1722, and it is a family document of great historic value. It is supposed that this precious relic was sold on account of the financial stringency affecting the deposed Imperial family, who have been in retirement on a limited income ever since the establishment of the Chinese Republic.



A Curb for Joy Riders | A Comfortable Racing Seat | Automobile Tail Lamp

Some Handy New Inventions

An Automatic Curb for the Motor Truck Joy Rider

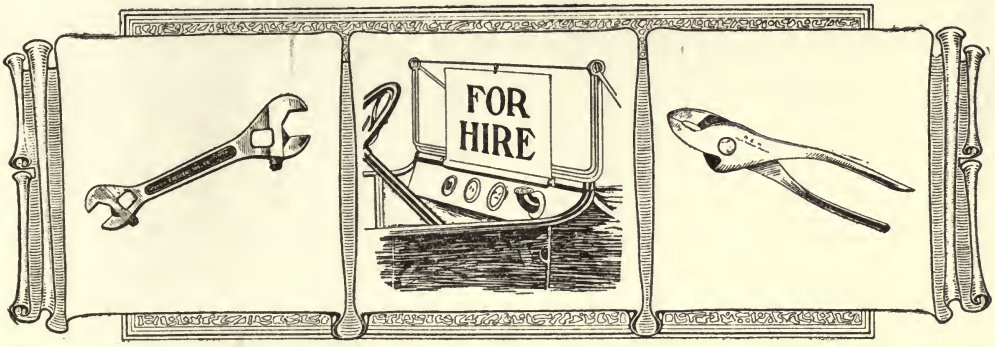
A device which prevents the misuse of motor trucks is now manufactured and should prove of interest to the motor truck owner who desires to extend the life of his motors to the greatest possible limit. It is known as the "Autoprotector," and acts as a check upon reckless driving. It calls attention to carelessness and by temporarily checking the speed causes the driver to pay attention to the careful operation of the car. Unlike other types of "governor control," the Autoprotector, so its manufacturers claim, is the only device on the market in which the full power of the motor is always available. In operation, when a violation of the proper and safe methods of running a motor truck or an automobile is incurred, the instrument at once comes into action and the car stops or a temporary reduction in speed takes place.

Comfortable Racing Seat

That the automobile racing craze is not "here today and gone tomorrow" but is an institution firmly fixed among people who can afford racing cars is proved by the fact that an Ohio manufacturing concern whose output formerly encompassed a variety of automobile accessories has devoted its attention exclusively to the manufacture of racing seats. The seat which is shown in one of the illustrations is constructed of heavy galvanized iron framed in wood and covered with imitation leather of high durability. The cushion is removable.

"Wireless" Tail Lamp

A tail lamp for automobiles has been put on the market to replace the oil lamps on automobiles not equipped with storage battery systems. In one sense, the new lamp is "individual," because it contains its own battery and a universal socket, so that the only effort required to attach it is to hang it on the bracket formerly occupied by the oil lamp. When the battery is dead it can be quickly replaced by slightly turning the lamp top and slipping the new cell into the body of the lamp. The connection is made with the center pole of the battery, and the top is replaced. The light is turned on or off conveniently by means of a small button on the side. The side lenses are corrugated crystal and corrugated ruby in the rear. The advantages of the new lamp are that it is not affected by rough roads or heavy winds, that it does not accumulate soot and grease, and, lastly, that it can be removed and put into service as a trouble lamp. Used intermittently it will burn from fifty to one hundred hours, according to the battery. These lamps are also furnished with green or crystal rear lenses, suiting them for marine as well as for automobile purposes.



An Adjustable Wrench | Sign That Rolls Up | Pliers of Improved Design

A Tool That Takes the Place of Nine Wrenches

An adjustable wrench which will replace nine sizes of solid wrenches has recently been put on the market. The "Crescent" wrench, as it is called, follows in outline the 22½ degree engineer's wrench. It was originated to meet the demand for a tool that would equal the solid wrench in efficiency and eliminate the necessity of having a separate wrench for each sized nut. It is drop forged of open hearth steel made according to a special formula. The heat treatment is unusually interesting. Ordinary case hardening hardens the surface of the tool but leaves the interior porous and brittle. To administer the correct heat treatment which will result in toughness both exteriorly and interiorly is the result which the manufacturers of this wrench worked for several years to accomplish.

"For Hire" Sign That Rolls Up

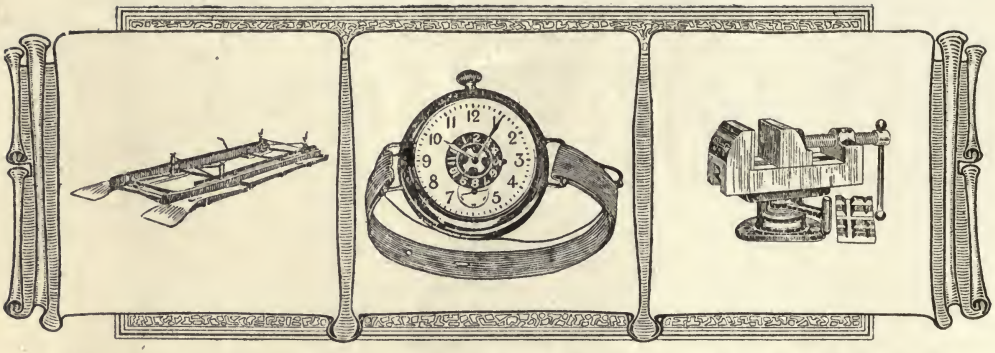
A "For Hire" sign for use on "Jitney" busses, which rolls up out of the way when the automobile is commissioned, is in general use among the chauffeurs of Portland, Oregon. The sign is built like a shade, consisting of an ordinary white or light cream-colored window shade about eighteen inches wide on both sides of which are painted the words "For Hire" in large letters. The shade roller is attached by screws directly below the wind shield frame. When the automobile is untenanted, the shade is drawn up and hooked over the top edge of the glass. When the automobile is in use, the sign is rolled up out of the way.

Pliers That Work Close to a Wall

Hand-forged pliers which are the acme of simplicity and durability—simplicity to the degree that they are only manufactured in one size, and durability in that they are made of hand-forged tool steel—are now being manufactured to meet the exacting wants of the iron worker and electrician. The jaws have a large compass; that is to say, they will grasp surfaces of varying size, while the cutting teeth are so incorporated into the design that a wire can be easily cut, no matter how close to the wall or to a similar wire or bundle of wires it lies. The "D. & H." pliers, as they are known to the trade, can be readily sharpened or renickeled. They are seven inches in length.

An Automatic Automobile Jack

An automobile jack that works automatically is one of the latest luxuries that have been perfected for the motorist. The jack, which is a long, low affair, is placed on the floor of the garage, the automobile is driven upon it, the wheels following guides. When the proper place is reached the car is stopped and four traps automatically drop from beneath the four wheels. This is accomplished without lifting the weight of the car. The car is left supported on rubber



An Automatic Automobile Jack An Alarm Watch That Pinches Vise With a Swivel Base

cushioned jacks with all wheels free to be turned. To remove the car from the jack, a foot trip is depressed, and the car is gently backed down under its own power. The weight of the car backing out automatically resets the jacks. This contrivance is of unusual interest when it is remembered that only a fraction of a second is required to jack up all four wheels—a feat accomplished with no effort on the part of the driver whatsoever.

A Silent Alarm Clock

Alarm watches that signal the time for which they are set by a shrill ringing are common, but a "noiseless" alarm watch which accomplishes the same result is entirely new.

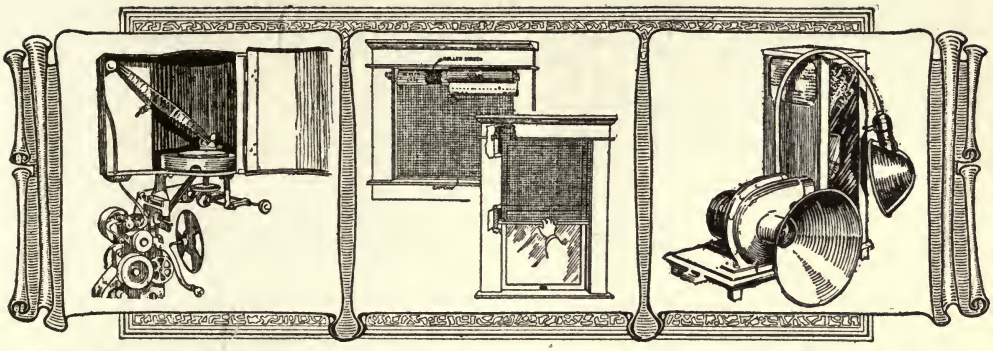
The story has been told of a married man who possessed a ringing alarm watch and who, with his wife, was awakened every morning by the silvery tinkle of the watch under his pillow. It took this man's wife five years, so the story goes, to discover that the alarm watch and not the neighbor's alarm clock was really awakening her every morning. The noiseless alarm watch, however, performs its early morning task differently. The noiseless alarm consists of a cord which tightens about the wrist, the pressure gradually increasing until released by the wearer of the watch. This is accomplished by pushing a small slide and twisting the stem of the watch a half turn.

Ingenious Vise for Drill Presses

A vise mounted on a swivel base, which particularly adapts it for use in connection with drill press and shaping work, is one of the latest entries into the hardware market. A swivel base of this sort is a new feature in vises and one that should be quickly appreciated by tool makers and machinists. The swivel base is easily locked into the desired position. The weight of the vise and swivel is about thirteen and a half pounds.

New Projecting Machine Averts Rewinding

The lost motion and the danger from fire which are present in the usual motion picture projecting booth are entirely eliminated in a new projecting machine recently placed on the market. Rewinding is unnecessary. The film, as it flows past the condensing lenses, is wound in a reel as usual. This results in the beginning of the film being at the center of the reel. Instead of rewinding, the film is placed in a metal canister above the shutter and the machine "threaded" from the center of the reel. The advantages claimed for this new method, aside from the labor saved in banishing the task of rewinding, are that the operator can give more attention to the operation of his projector, the life of the film is prolonged and the chances of a film breaking because of tension are greatly lowered.



A Non-Rewinding Film Device An Adjustable Window Screen An Electric Fly Catcher

Window Screen on a Roller

A practical type of disappearing roller screen has been devised which can be installed without a special type of frame and is quite simple in construction. The screen rolls into a metal cylinder two inches in diameter, similar to those commonly used for house shades. On the bottom of the screen is a metal slide which moves in a groove on either side of the window frame.

The advantage of this type of screen is that it can be rolled up out of the way when not in use and is thus well protected in case of rain or snow storms.

Another advantage of this screen is that when it is not required—when the window is closed—better light is obtained.

Electrical Fly Catcher

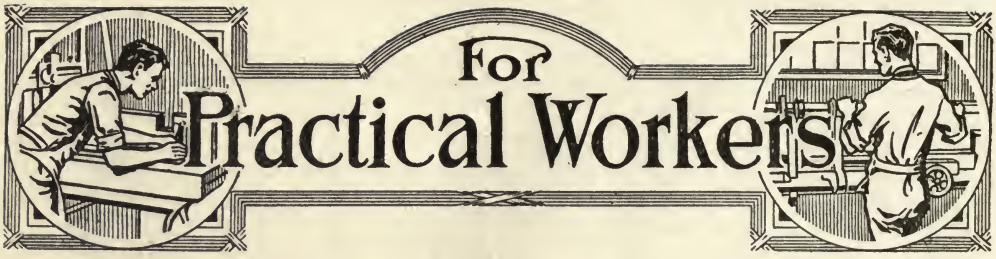
A fly catcher which operates on the principle of a vacuum is the latest addition to the sanitary forces of the "swat the fly movement," as it is popularly expressed. Various types of mouthpieces are utilized, and extensions can be made in any direction to catch flies or insects. The fly catcher performs a double function, its latter being that of an air circulator. A moistened sponge is placed over the opening of the outlet and saturated with disinfectants or perfumes, as desired. At night time an electric bulb with a reflector is placed before the funnel-like trap, for the purpose of attracting moths and other "night" insects. In ordinary use in the daytime, various sorts of baits are used. It has been found by sanitary experts that milk attracts flies more quickly and numerously than any other substance. The "vacuum fly trap" weighs about thirty pounds and consumes as much current as a 16 c. p. carbon filament lamp.

Using Kerosene to Extinguish Fires in Cotton Bales

Kerosene would not seem of much value as a fire extinguisher, yet the Standard Oil Company of California recently sold a barrel of it for that purpose. It put the fire out, which was something water could not have done.

The fire was inside a bale of cotton in a warehouse. Cotton is packed so tightly that water will not penetrate deeply, so that, although the outside of the bale may be wringing wet, the fire may be still eating its way slowly through the cotton inside. Kerosene is much more penetrative than water, and will go to the center of the tightest bound bale.

Such kerosene soaked cotton requires a higher temperature to ignite it than the fire inside can reach, due to the tight packing and lack of air. Consequently, the fire stops when it reaches the kerosened part. After waiting a day or two for the fire to burn itself completely out, the bale is broken open and spread out for the kerosene to evaporate, leaving the unburned cotton as good as before.



A HOME-MADE POWER HACK SAW

By Ray F. Kuns.

The power hack saw is a well-known time, labor and material saver. The machine illustrated will cut anything which can be held in the vise, from thin brass tubing up to four-inch solid bar. The feed is automatic and may be varied by means of the sliding weight to suit the cut being made. Once correctly adjusted the machine needs no further attention until the cut is finished.

The wheels, frame, carriage, vise jaws and other wood parts are made from oak, maple or other hard wood. The metal parts are mostly of mild steel, excepting, of course, the cold rolled shaft and the vise screw. Inasmuch as there are no hard joints to make, the wood parts may be very quickly gotten out and fastened together.

BASE: Use one solid piece for the base, working out approximately to the size suggested.

BEARING SUPPORT: Two of these are required. Refer to page 349 for detail and to *B S*, below, for the location on the base. The hole may be bored with one inch auger bit and used for the bearing, or it may be worked out larger and bushed or babbitted. The hard wood bearings will run quite a while, even for continuous use, in a machine of this kind, since it should run but forty-five strokes per minute. The support is fastened to the base by means of bolts or lag screws.

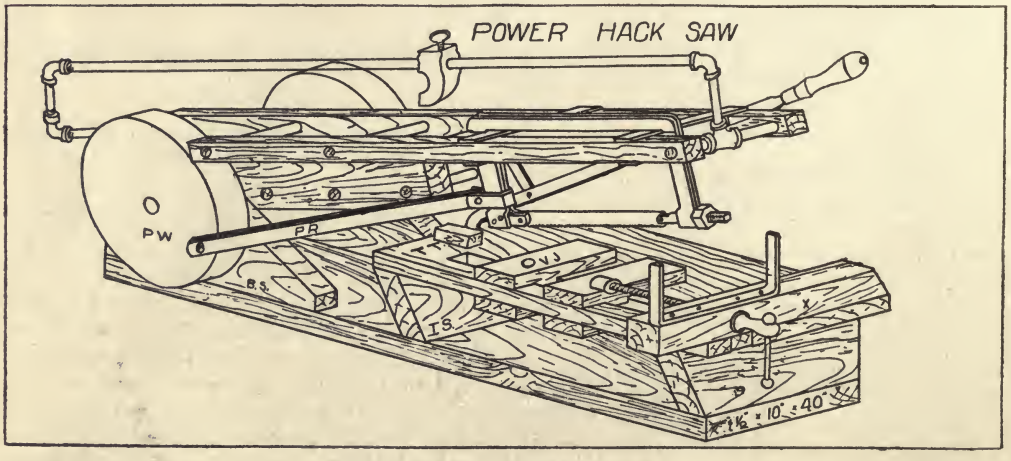
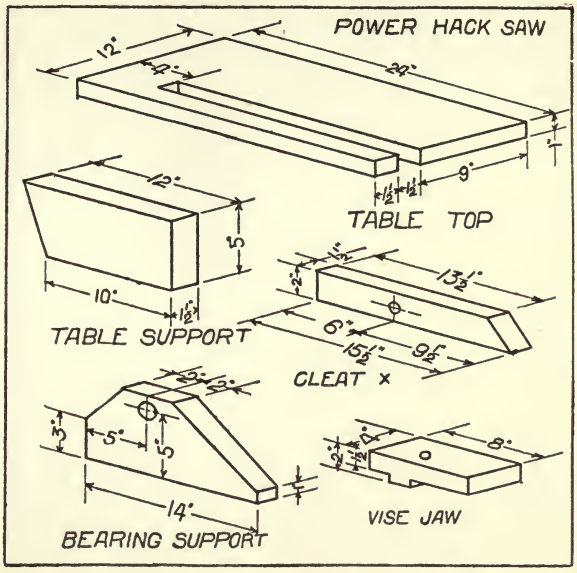


TABLE: Get out the table top and supports, shown on page 349, and fasten them together with nails or screws. Secure the supports to the base by means of nails or lag screws. The supports may be braced to make the table more rigid.

VISE: Four jaws are required for this, the detail of which is shown on page 349. The two back jaws are held firmly in

place by means of the half-inch bolt which passes through both of them. Loosening this bolt permits of adjusting the jaws to accommodate the stroke of the saw to the work. The front jaws are also held together by means of a half-inch bolt which is kept just tight enough to allow the jaws to slide back and forth.

The vise screw is taken from an old broken vise. The nut is fastened to the top one of the front jaws by means of bolts. A washer is placed on the screw on the inside of the cleat *X* and a 3/16" hole drilled for a pin on the outside of this washer. This prevents the screw from forcing back through the cleat as the vise is tightened.



SAW CARRIAGE: In working this up it is necessary to bear in mind the work to be handled. It is designed to fit between the bearing supports which have been previously described. It is attached to the frame and supported entirely by means of the shaft passing through the two holes shown in the detail on page 350. Inasmuch as these support much of the weight of the carriage, and the shaft turns in them, they should be arranged as bearings and provision made for oiling them.

The saw carriage is held together by means of ¾" dowel rods, which are held in place by means of screws. Two iron braces are also fastened on, as suggested in the detail, to insure the rigidity of the frame. These braces are of ¼" x 1" iron or mild steel.

Especial care should be used to have the space for the slide true and smooth.

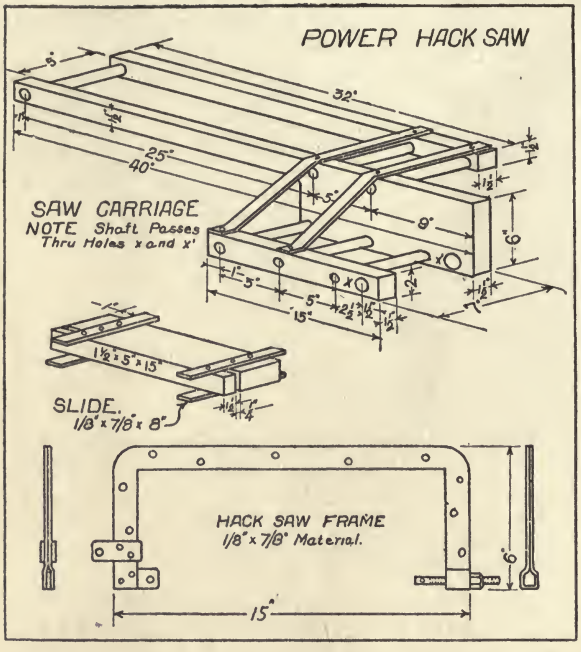
SLIDE: This is very simple. Four iron plates are fastened on the wood block, as suggested in the sketch. Either screws or bolts may be used for this. The holes shown cut in the ends of the wood block fit the frame which holds the saw.

HACK SAW FRAME: This is also detailed. As in all frames of this nature, provision must be made for tightening the blade. In this case threads are cut on a 5/16" piece of cold rolled steel or iron. A pin for holding the end of the blade is riveted in one end of this piece. This end of the bolt, as it may be called, should have no threads on it, but instead should have the side the rivet projects from filed flat, thus permitting the saw blade to come to the center of the frame. This will also keep it from twisting. The threaded portion of the bolt is next filed square, preventing it from turning in the frame as the nut is tightened, as well as holding the blade in alignment.

The frame itself needs little description. It may be made as shown or worked up from a piece of quarter-inch material. The method shown requires that the parts be riveted together. The end opposite the bolt has a small piece of ⅛" x ⅞" material riveted in. This in turn has another pin, for holding the saw, riveted into it. A clip of the same material is made and riveted onto the frame just above this piece. This clip has a hole drilled through its open end to allow for connecting the end of the pitman rod. A 3/16" pin is about right for this.

PITMAN ROD: This is marked *P R* on page 348. It may be made from solid stock, or ⅛" x ⅞" stock may be doubled for it. The length should be figured after the rest of the machine is assembled.

PITMAN WHEEL: Made from 2" maple or oak, as is also the pulley wheel. The



pitman wheel is ten inches in diameter. An eight-inch stroke is about the proper length for ordinary work with a 12" blade in the frame. A shorter or longer stroke is easily obtained by varying the location of the 5/16" x 1½" lag screw which is used to fasten the end of the pitman rod to the wheel.

PULLEY WHEEL: This may be something on hand or worked up for the need. The size of it must be varied to secure a speed of about 45 strokes per minute.

SHAFT: A piece of 1" cold rolled steel is used for this. If tight and loose belt pulleys are to be used it should be of a suitable length to accommodate them.

A half-inch lag screw should be run in from the rim of the pitman wheel and into a hole countersunk into the shaft for it. This will secure the wheel in its place and effectually prevent all slippage. A very neat job may be made of the set screw by sawing off the head and then sawing a slot in the end thus left, to serve as a hold for the screw driver when tightening it.

SLIDING WEIGHT: Some ⅜" pipe and fittings were used for this, as shown in the drawing. The weight itself is merely the front jaw off the old discarded machinist's vice from which the screw was taken. A set screw is provided to keep this in place, though it is not absolutely essential.

LEVER: This is provided for raising and holding the saw away from the work.

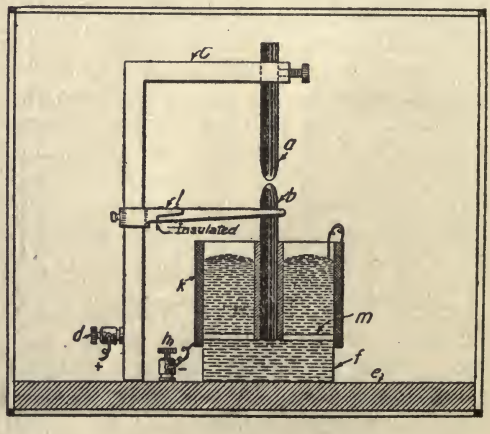
BRACKET: An iron bracket is provided as a guide for the front end of the saw carriage. It is merely to prevent any lateral movement of the carriage in actual use. This is shown fastened on cleat *X* on page 348.

This saw has been in almost constant use for nearly one year and is giving good satisfaction. Perhaps the heaviest duty it has done was when it was used to slot an armature for an electric motor. In this case 16 slots, each ¼" wide, ⅜" deep and 3¼" long were cut. Six blades were used in the saw at one time to give the proper width to the grooves or slots.

An Easily Constructed Arc Lamp

A self-operating arc lamp, which can be made of simple materials, can be constructed as follows:

An L-shaped brass standard, *C*, of heavy stock should be machined or cast and fitted with a brass binding post, *D*, and bored with holes for the carbon, *A*, and a set screw to hold the carbon in place. The other carbon, *B*, slides in a



hole in the end of the arm, *L*, which is locked to the standard. This arm should be insulated, as shown, by a fibre joint. The self-operating device consists of a glass vessel, *f*, around the upper part of which a layer of heavy magnet wire (No. 14 is large enough) is wound. The vessel is nearly filled with mercury. The carbon, *B*, fits in a heavy iron sleeve which sinks into the mercury until its weight and that of the carbon and holder are displaced.

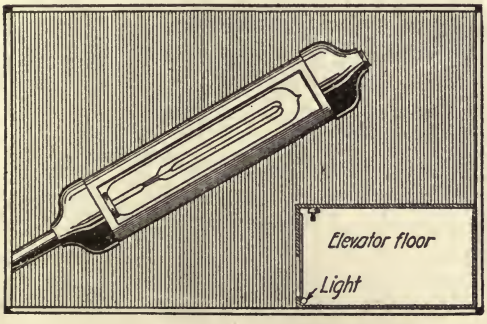
Current flows from the two binding posts through the coil and mercury and the two carbons, which are touching. The energized coil causes a solenoid effect, drawing the lower carbon down into the mercury until the arc is the correct length. A metal strip, *M*, is placed across the mercury vat and is bored with a hole of sufficient size to admit the passage of the iron sleeve. In that way the lower carbon is guided. The weight of the mercury pushes the carbon upwards.

Contributed by

NOORMAN WINDERLICH.

An Elevator Lamp That Insures Safety

The danger of persons stumbling upon entering or leaving elevators because of the unequal levels can be eliminated by the use of a lamp having a shielded ray,

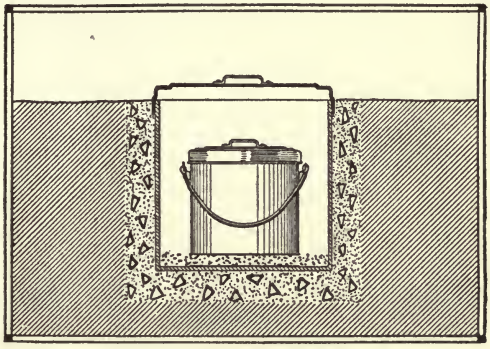


as shown in the accompanying drawing. The lamp should be attached to the floor of the car by means of a crow-foot, and connected so that it will light when the elevator is stopped. This can be accomplished by making an extra connection or two at the starting switch.

Contributed by JOHN J. KUNTZ.

Sanitary Garbage Pail Container

Garbage pails, unless they are kept scrupulously clean, draw flies and thus spread disease. The simplest way to prevent this condition is to dig a pit in which a pail large enough to hold the garbage can is placed. Between the larger



pail and the earth surrounding it a thick layer of coal ashes should be poured and tamped. The smaller pail is placed within the larger one, as shown, upon a layer of tamped ashes. The cover of the large pail is elevated a short distance.

Contributed by

FRED KUNCHMAN.

To Punch Holes in Steel Springs

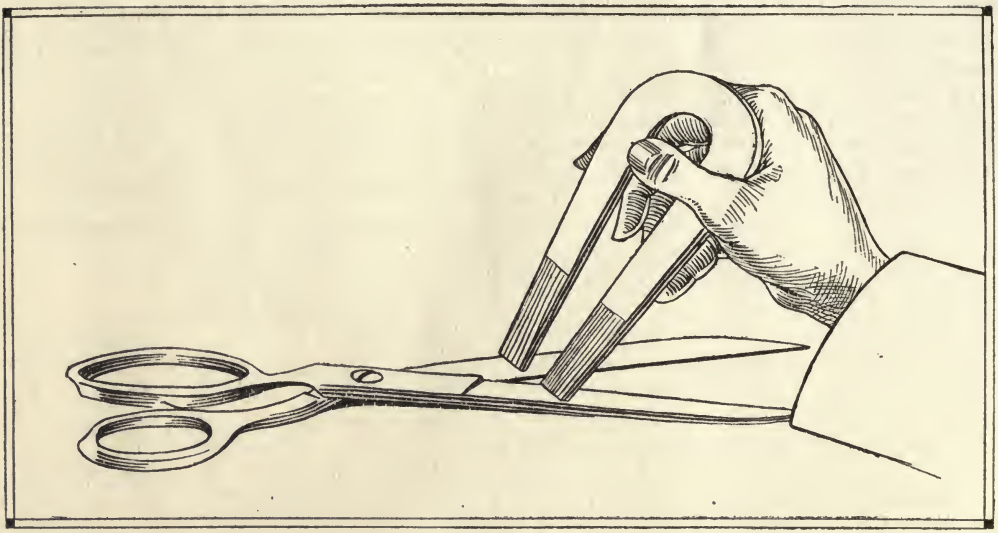
Holes may be punched in steel springs or other stiff metal if a plate of thin galvanized iron or brass is placed between the metal and the anvil. Two or three thicknesses may sometimes work better than a single sheet. The punch should have a flat end surface and, preferably, a shank which does not taper.

Contributed by

J. C. LINDSTROM.

Magnetic Scissors That Picks Up Needles.

A pair of magnetic scissors will be found very useful in the sewing room and elsewhere about the house. It will pick up needles or other iron or steel articles, but will not attract any other metal. This will enable any one to distinguish between brass hooks and iron ones which must not be used on clothing that is to be washed. A small horse-



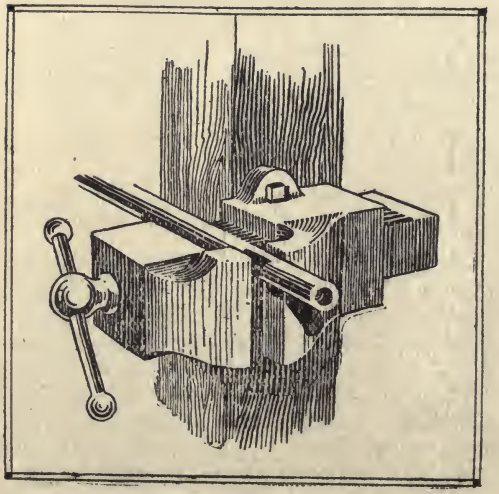
shoe magnet can be employed for magnetizing any pair of scissors. To magnetize the scissors the two poles of the magnet are placed in contact with the scissors near the pivot, and drawn to the end of the blades. This operation is repeated several times, care being exercised that the same poles of the magnet touch the same blades of the scissors.

Contributed by

WM. C. HOUGHTON.

Setting Up a Vise for an Emergency Piping Job

The author was recently confronted with the problem of doing a little piping job around his machinist's vise where there was not enough room to work in. The problem was solved by removing the vise from the bench and bolting it to a convenient door jamb. One of the posts supporting the floor above would have served the purpose equally well, and even a brick pillar or iron post could have been utilized by making a rough clamp of two by four inch timber and a couple of long bolts or studs. When fastened to the door jamb, the vise had to be placed with the jaws vertical, but it served the purpose nicely.



Contributed by

WM. C. HOUGHTON.

A Belt Dressing Tool

Belt dressing compound can be applied evenly to a belt surface by using a spool wrapped with cloth and revolving easily upon a handle of some sort.

Contributed by JACOB LIEBMAN.

Typewriter Eraser Holder

Instead of bothering to look for the typewriter eraser on the numerous occasions when it is needed, a much better plan is to bore a small hole in the table near the typewriter, thread a length of stout string through it, attach the eraser

at one end and a light weight at the other. The weight should be slightly greater than that of the eraser. When the eraser is not in use the weight pulls it down over the hole, where it can always be found promptly when it is wanted.

Contributed by

L. C. LUNDHOLM.

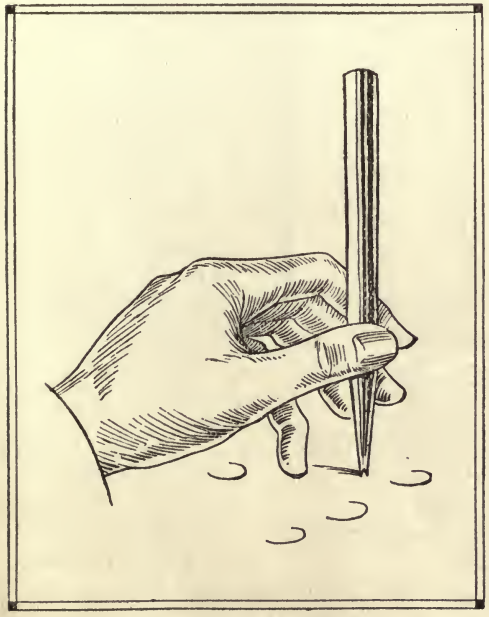
Reviving Dead Rubber

Elasticity can be restored to rubber by dipping it in a mixture composed of one part household ammonia and two parts water.

Contributed by FRED MURSCH.

A Handy Tool for the Layer-Out

A very handy and time-saving tool for the layer-out engaged in sheet iron or boiler work is a double center punch for

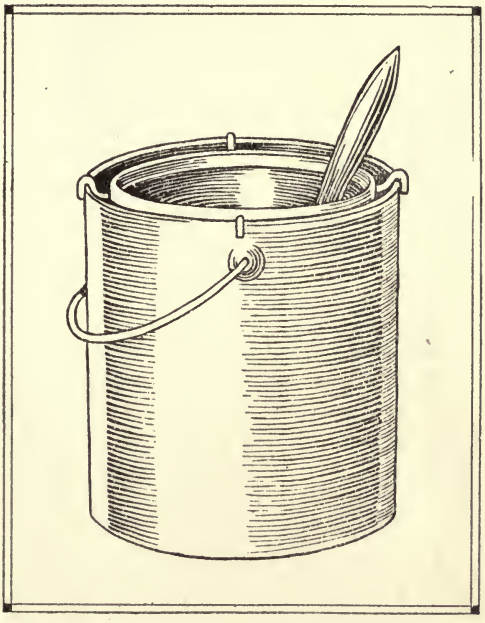


the centering of flange or shear lines which are usually centered with two marks close together for the purpose of distinguishing between the center marks for holes and those of the shear or flange lines. The idea is made clear by the illustration.

Contributed by N. H. BABCOCK.

Convenient Paint Brush Drainer

It often happens that the handy man desires some form of device for keeping the outside of a bucket free from paint, while painting. An idea for accomplishing this result is shown in the accompany-



ing illustration. It consists of a strip of metal bent in the form of a circle of such size as to be slightly smaller than the bucket into which it fits. The circle is held in place by small hooks which fit over the top edge of the can.

Contributed by

W. R. COTTRELL.

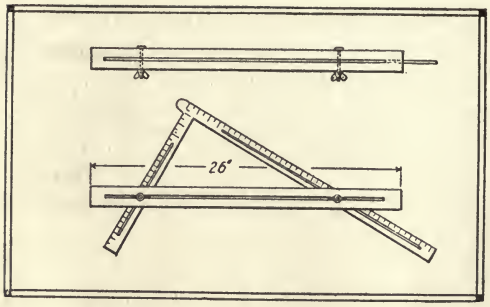
Removing Adhesive Tape Painlessly

The usual pain which accompanies removing adhesive tape from cuts or bruises can be avoided if a few drops of benzine are applied to the edges.

Contributed by CHARLES A. ALLEN.

Pitch Board and Template for Stair Builders

A new idea in tools for designing stairways is suggested in the accompanying drawing. It is constructed of steel, and should be made according to the propor-



tions given. This pitch board and template may be used on other work than building stairs—laying out trusses, rafters, braces, etc.

Contributed by

WILLIAM ALBIN.

Large Drill in Small Press

Drilling a hole larger than the maximum capacity of a small drill press can be done by turning down the shank of the drill to a size that will fit the chuck. The hole should first be drilled a size smaller than is desired; then the large drill used. This step is necessary, because the speed of the average small press is too fast for a large drill.

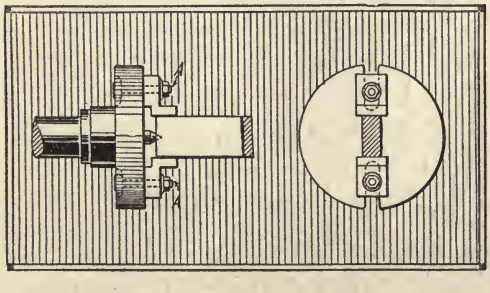
Contributed by

CHARLES H. ANDERSON.

A Hint for Lathe Workers

Work with parallel sides can be easily driven if two pieces, *A, A,* as shown in the drawing, are added. These pieces can be made from flat, cold-rolled steel, by bending the steel to the desired shape and drilling the bolt holes. These clamps can be adjusted to fit any sized stock within reasonable limits.

Contributed by C. H. ANDERSON.



Cutting Glass with Shears

Sheet glass, provided it is not too thick, can be cut into any desired shape with a pair of heavy shears by submerging the shears and glass in water. The edges may be smoothed afterwards with a file or sandpaper.

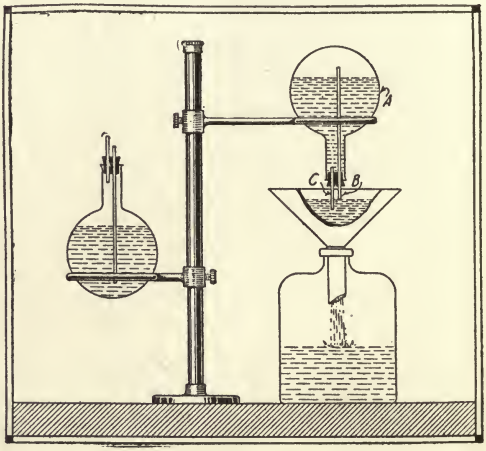
Contributed by

FRED. W. POTTER.

A Filter for the Chemist's Laboratory

To filter large quantities of chemical solutions, an apparatus constructed as follows will give satisfactory results:

A is a large flask or bottle into which the solution to be filtered is poured. It is inverted so that the ends of the tubes, *B* and *C*, are some little distance below



the top of the funnel. The solution runs out of tube *C* until the rising liquid closes the end *B*, thus automatically checking the flow. This goes on continually until the whole of the solution has been filtered.

Contributed by

G. E. WELCH.

A Chemical Barometer

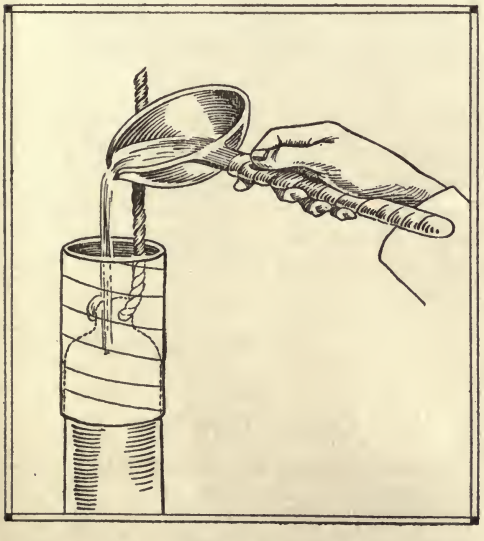
Chemical barometers, although not as sensitive as the mechanical type, will indicate changes in weather, and they are unique. A fairly reliable chemical barometer can be made by dissolving ¼ ounce of powdered camphor, 62 grains of powdered potassium nitrate and 31

grains of ammonium nitrate in two ounces of alcohol. The solution should be put into a slender bottle, over the mouth of which is stretched a diaphragm of thin rubber punched with a tiny hole. During fair weather the liquid will remain clear, with the solid particles settled close to the bottom. If a high wind is coming, the liquid will take on the appearance of fermentation, a film of solid particles spreading over the surface. The approach of rain is signaled by the formation of crystals throughout the solution.

Contributed by
GEORGE W. GREENE.

Making Sash Weights Heavier

The author experienced trouble with his windows which would not stay up because the weights were too light. After determining how much additional weight was needed, the weights were taken out, cord and all, exercising the precaution of drawing in a thread for pulling the cord back. Some heavy wrapping paper was then wrapped around the head of each weight, tied tightly in place and melted

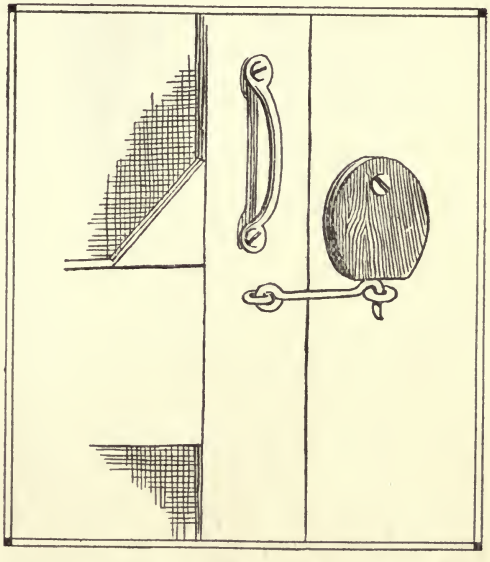


lead poured in. This flowed around the cord and head of the weight, making a neat job.

Contributed by
WM. C. HOUGHTON.

A Safety Lock for Hook on Screen Door

A simple safety lock for the ordinary hooks used on screen doors can be made from a block of wood half an inch thick,



two inches high and one inch wide. The corners are cut off so as to give it the shape shown in the illustration. A hole is then bored in one end so that it may be fastened in place. The other end is cut off in order that it will cover the hole of the eye.

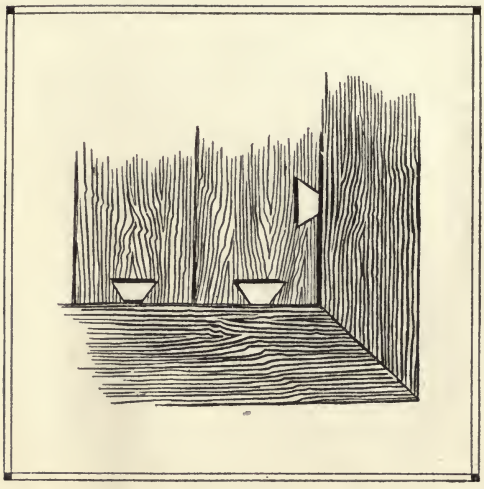
The block of wood is then screwed over the eye sufficiently tight so that it will remain in whatever position it is placed. The action of the lock can be easily understood by studying the drawing.

Contributed by
THOMAS SHEEHAN.

To Moisten Fingers Without Chapping

In order to prevent the chapping of the fingers of clerks who are compelled to use finger moisteners continually, an army surgeon has suggested that a small amount of glycerine be poured into the container of the moistener with the water.

Contributed by
CHARLES M. STEWART.



Glazier's Points for Fastening Pictures in Frames.

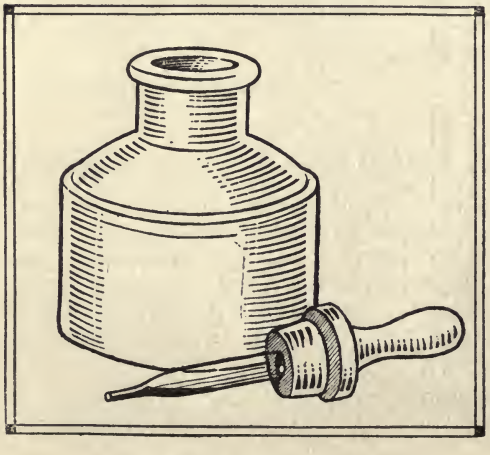
The little triangular pieces of sheet metal known as glazier's points will be found more suitable than nails for holding the backing in picture frames. They may be bought at hardware stores or, if only a few are required, they may even be quickly cut out with a pair of shears. Zinc is the metal commonly used, although tin or sheet iron will serve.

Contributed by

WM. C. HOUGHTON.

Fountain Pen Filler in the Ink Bottle Stopper

The fountain pen filler is a messy thing to keep around the desk and is apt to be mislaid at that. A convenient way of keeping a filler is to bore a hole through an ink bottle stopper and push the filler through it. The filler will then be always handy when wanted and perfectly clean.



Contributed by

WM. C. HOUGHTON.

Gilt Signs on Glass

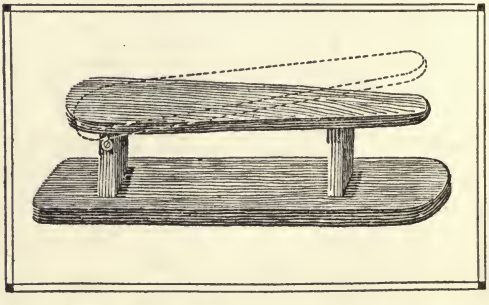
Gilt letters may be painted neatly upon glass surfaces by outlining the letters in varnish, then dusting on gilt powder.

Contributed by

FRED KUNCHMAN.

Ingenious Sleeve-Pressing Board

An ironing board for pressing sleeves can be improved considerably by hinging the top board. The nails should be removed, the standards strengthened and the broad end of the board hinged by means of screw-eyes to one of the standards. The top of the upright upon which the board hinges should be planed round.



Contributed by

WM. C. HOUGHTON.

Resined Cord Tips

If flexible cord tips are resined instead of wrapped with fine wire as is usually done, they will not fray, and their appearance is much better. The resin should be applied to the wire, and the braided sleeve pulled down to the nickeled tip and rolled between the fingers.

Contributed by

NORMAN B. DORWART.

To Oil Automobile Springs

If the leaf springs of automobiles are oiled carefully the car will ride much easier and the life of the springs will be considerably lengthened. The leaves should be pried apart with a screwdriver or chisel and the separated surfaces swabbed with a feather 6 or 7 inches in length, which has been saturated with oil.

Contributed by

JOHN HOECK.

Prevents Drawer Falling

If the drawers of tables or dressers are pulled out too far, the drawer often falls, and the contents are scattered on the floor. This inconvenience can be prevented by screwing a small metal catch at the back of the drawer, so that it projects upward far enough to catch the upper panel when the drawer is pulled out.

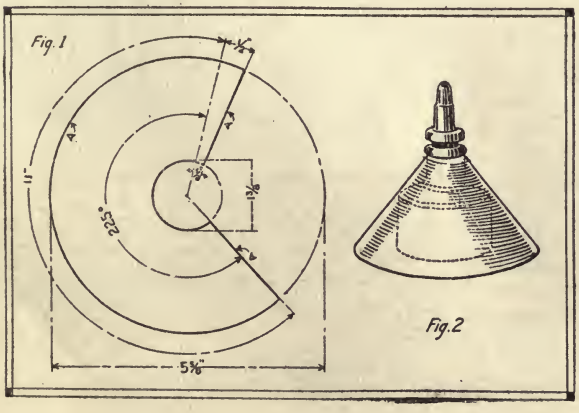
Contributed by

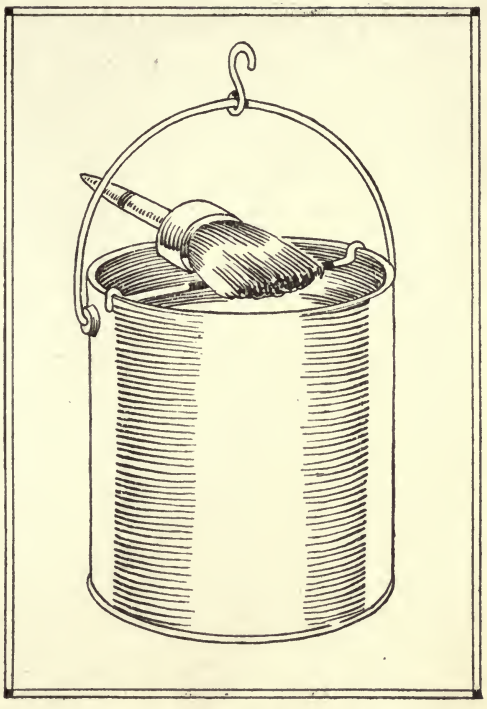
B. W. VERNE.

An Ink Bottle That Will Not Upset

The ever-present danger of an india-ink bottle tipping over and spilling its contents upon an unfinished drawing can be averted by building up a conical cardboard support, such as is shown in the accompanying drawing. The cardboard should be as stiff as is procurable, and cut and assembled as shown in Figs. 1 and 2.

Contributed by L. B. LAWRENCE.





Two Hints for the Amateur Painter

The amateur painter will find the following hints of great help to him in his work.

It is often desirable to hang a pot of paint from a rung of a ladder, while painting a ceiling or a wall. This can be easily accomplished by bending a heavy piece of wire in the shape of an S and using it to hold the paint pot.

The second device is to eliminate the necessity of laying the brush on the ladder or on some surface where it can pick up dirt while moving the ladder from place to place. It consists of a piece of stout wire, bent as shown so as to fit diametrically across the pail. The brush may be laid on this wire and there will be no danger of its becoming laden with dirt or its handle covered with paint.

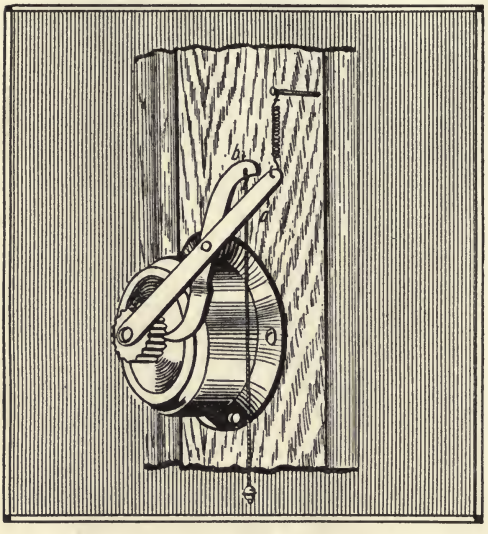
Contributed by

C. S. ROBINSON.

Contributions to this department will be paid for at space rates, with a minimum of one dollar per idea.

Chain Attachment for Snap Switch

The accompanying drawing illustrates a snap switch equipped with a scissors-like ratchet and string to avoid the time-consuming operation of feeling for the knob and twisting it as is usually done.



A little adjustment will be required to determine the correct spring tension.

Contributed by

DAVID SCHELL.

Vise for Polished Pipe

Polished pipe can be held in a vise without scratching the surface if the pipe is rolled in paper upon which plaster of paris is plentifully sprinkled.

Contributed by

JACOB BLASS.

Removing the Tarnish from Silver

Tarnish may be removed from silverware by means of a "silver tarnish battery." For the battery, a tin pail or a pan is required, in the bottom of which two strips of zinc are placed cross-wise. These strips should be about one inch wide and a little shorter than the diameter of the containing vessel. The pail should be half filled with hot water, and for every quart of water four teaspoonfuls of salt and one of baking soda should be added.

To remove the tarnish, the silverware should be placed in the pail so that some part of it comes in contact with the zinc strips. The tarnish will disappear rapidly. The experiment should not be tried with oxidized silver, as the electrolytic action causes the oxidized surface to be eaten off.

Contributed by

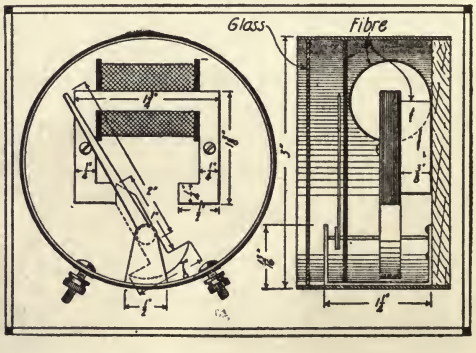
CLYDE MORGAN.

A Polarity Indicator

This instrument may be used for determining the direction of a storage battery charging current. Its operation is based on the fact that unlike magnetic poles attract and like poles repel.

The case is made from fibre or hard rubber. The magnet core is made of solid iron or soft steel—it must be permanently magnetized. The pointed end of the armature should have a known polarity. The purpose of the weight on the armature is to bring it back to an upright position. The pointer should be made of aluminum on account of the lightness of that metal. The size of the wire used on the magnet will depend upon the current with which the instrument is to be used.

The dial should be marked according to the following directions: Grasp the



coil in the right hand, so that the fingers encircle it in the direction of the north pole. The dial may be divided in any way, to indicate the direction of the current.

Contributed by

CLARENCE POOL.

Acid Pyrography

Artistic designs can be burned in wooden surfaces by the use of an acid solution formulated properly with equally as good results as are obtained with the pyrographic needle.

A 20 per cent. solution of sulphuric acid should be mixed in an ordinary ink bottle, and the liquid tinted with red ink or other coloring matter, so that the acid line will be visible when it is applied.

After the design has been printed or drawn on the wood surface, a tailor's iron should be rubbed carefully over it until the desired shade is obtained. The acid should be painted over the design with a small camel's hair brush.

Contributed by

J. BRAFF.

Pole Testing Paper

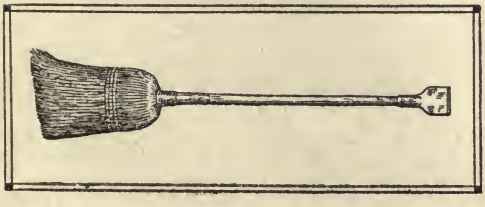
Pole testing paper can be prepared by soaking thin blotting paper in a starch solution; when it is dried and cut into strips, it should be immersed in a solution composed of ½ ounce of potassium iodide in 1 pint of water. The polarity of a current is determined by placing two wires ½ inch apart on a sensitized strip. The positive pole will be indicated by a violet covering.

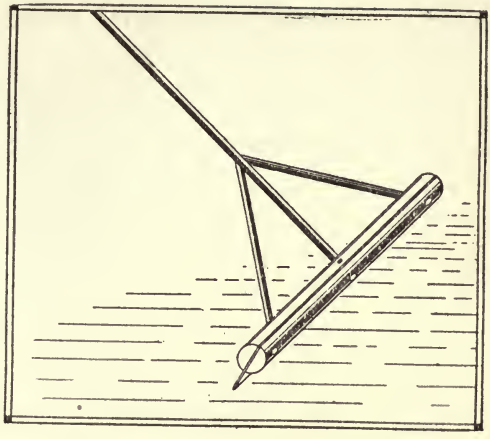
Contributed by G. W. GREENE.

Combination Ice Chipper and Broom

A combined broom and ice chipping tool will save time in cleaning the snow and ice from walks in the winter. The chipping tool should be removed from its original handle, driven on to the broom handle and held in place with wood screws.

Contributed by G. G. GUNKLE.





A Tennis Court Scraper

A serviceable tennis court scraper can be made in the shape of a large hoe. A wooden rod 2 inches in diameter should be sawed down the center and a thin strip of steel clamped between the faces of these two halves so that it projects about two inches from one side. In the center of the rod and at right angles to the blade a hole should be bored to fit the end of a long handle. The rod and the handle should be braced as shown.

Contributed by

ARTHUR EDGAR.

A Stove Leg Fastener

In moving or lifting stoves, the legs often drop out, or become loose. This can be prevented by bending a strip of heavy tin over the top of the leg, to fill the space between the top of the leg and the stove, and fastening the opposite end to some projection on the body of the stove.

Contributed by

B. W. VERNE.

Hanging Hard Wood Shelves

Instead of the usual wooden pegs for assembling the parts of hardwood shelves, a substitute which will serve the purpose equally as well consists of wire nails driven into one board, the heads filed off, and these protruding ends plugged into holes in the other board. A

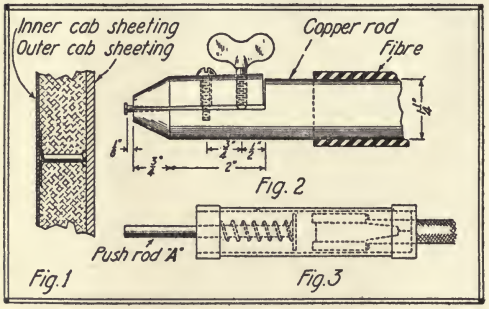
solid joint much stronger than could be secured with wooden pegs results.

Contributed by

ARTHUR CALL.

Spot Welding on Locomotives

A novel method of attaching a non-conducting, heat-resisting lining to sheet steel is used on the cabs of modern elec-



tric locomotives. This lining of asbestos board is necessary to keep the engineer's traveling quarters comfortable at all times—warm in winter and cool in summer.

One-inch nails are electrically spot welded by their heads to the inner surface of the outer steel sheeting of the cab, as shown in Fig. 1. The asbestos lining is driven home on the nails, which are then tightly clinched over large tin washers. A thin metal sheeting is applied over all, giving a smooth, finished appearance to the interior of the cab.

A more detailed description of the spot welding equipment is given, in the hope that it may suggest further uses of a similar nature.

A special transformer, capable of transforming about six kilowatts from a 550-volt shop circuit to a working pressure of from three to five volts, is used. At this low voltage a current of from fifteen hundred to two thousand amperes gives good results.

One of the low-voltage terminals of the transformer is connected by heavy cables to the locomotive frame, while from the other a heavy, flexible conductor (cable) carries the current to a sturdy copper terminal arranged to grip the nail for welding. A fibre sleeve, fitted over this terminal, furnishes a handle for the operator. The terminal is shown in detail in Fig. 2.

The primary circuit of the transformer is closed by a small, oil-immersed contactor energized by a 110-volt circuit. As approximately two pounds of nails are required for each cab, the operator must lose no time in making and breaking connections. An ordinary snap switch was found to be too slow and awkward to handle. A push-button control switch was made up from an old cartridge fuse and so arranged that the workman can close the circuit by pressing the rod, *A*, shown in Fig. 3, against the cab or locomotive frame.

Contributed by

HANDYMAN.

Grinding Ball Bearings

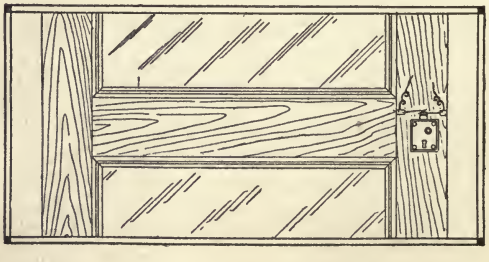
Bicycle hub cones, which have become deeply rutted by continued wear or not enough oil, can be renewed by placing them in a lathe and grinding down with an emery stone and fine sandpaper.

Contributed by

ARTHUR EDGAR.

Gives Warning When Lock is Touched

Door locks of the type wherein the bolt slides in and out of the rest of the mechanism, as shown in the drawing,



can be made "tamper-proof" by screwing two springs above the bolt, so that when the bolt is withdrawn from them they are separated. If the springs are placed in an electric circuit composed of dry cells and a doorbell, when the lock is tampered with, the bell will sound an alarm.

Contributed by F. T. STURTEVANT.

THE HOME CRAFTSMAN

FURNITURE FOR THE SUMMER COTTAGE

Describing the Construction of Simple Cottage Furniture of Substantial Design and Finish

By Ralph F. Windoes
Instructor of Manual Training, Davenport High School, Davenport, Ia.

Illustrations from drawings made by the author.

COTTAGE furniture, to be perfectly successful, must be substantial and capable of withstanding all sorts of weather conditions. It must also be neat in appearance, and comfortable. With these thoughts in mind, the author is presenting detail drawings of a porch swing, arm chair and rocking chair, with the hope that many craftsmen will utilize them in the construction of their summer cottage furniture.

Plain red oak is recommended for the lumber, as it is much cheaper than quarter sawed and just as strong if the pieces are properly built. Cypress might be substituted, but, being a softer wood, it would not stand up under the "roughing" as well as the oak.

PORCH SWING.

For the porch swing will be needed the following stock, planed and sandpapered to dimensions at the mill:

2 pcs. 1¾" x 1¾" x 27¼", back posts.
2 pcs. 1¾" x 1¾" x 16⅝", front posts.
3 pcs. ⅞" x 5" x 59", long rails.
1 pc. ⅞" x 4" x 59", long rails.
2 pcs. ⅞" x 5" x 24", end rails
2 pcs. ⅞" x 5" x 27", arms.
2 pcs. ⅞" x 2½" x 21½", seat supports.
6 pcs. ½" x 5½" x 11", back slats.
4 pcs. ½" x 5½" x 12", end slats.
11 pcs. ½" x 1½" x 57", seat slats.
4 iron brackets with hooks attached.
1 set porch swing chains.

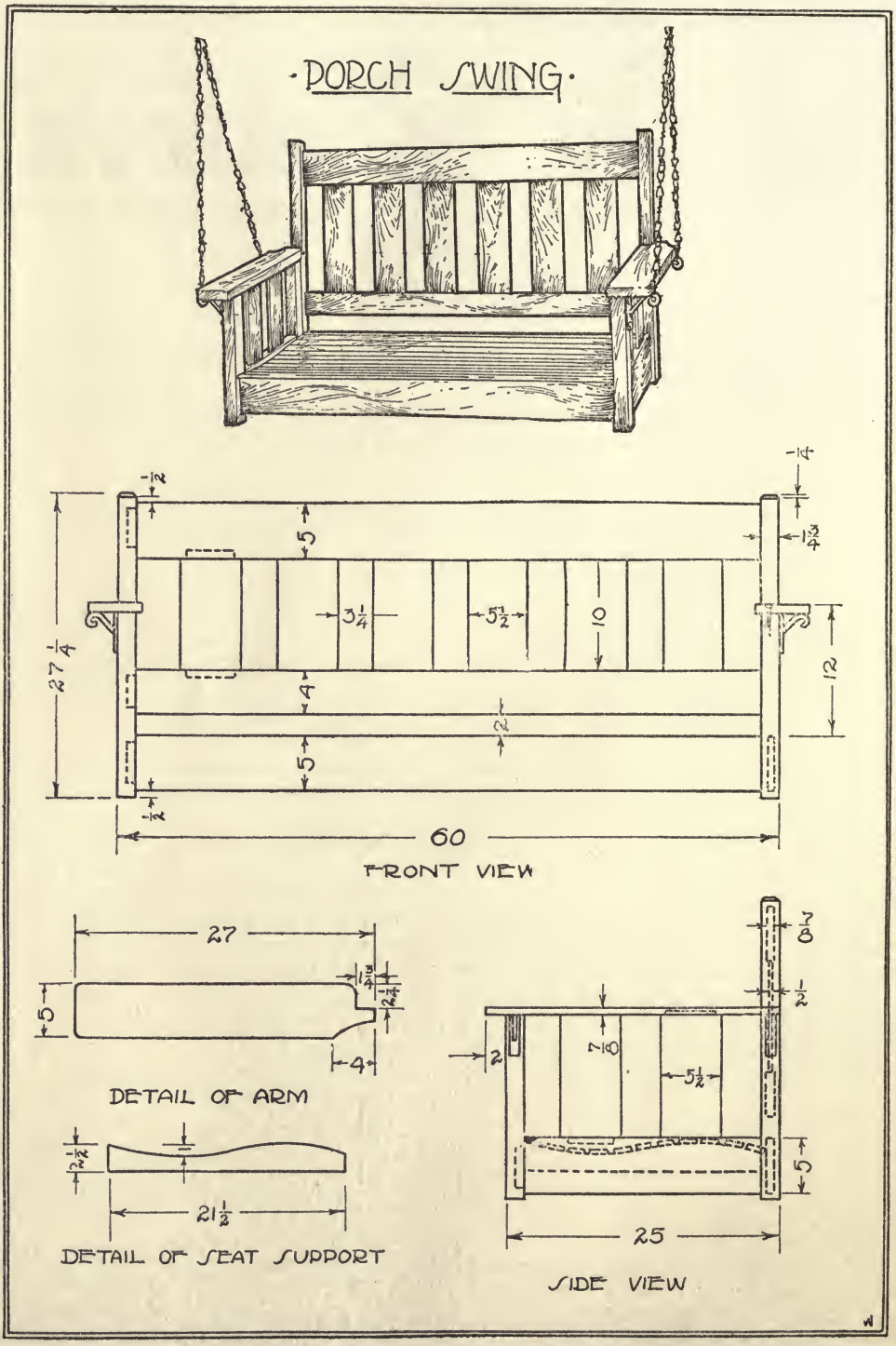
Begin the construction, as usual, with the posts. Square up the stock, and cut the mortises in them. Cut their corresponding tenons on the rails and clamp up dry. Fit the back slats into place and glue this much up. The arms are detailed, and are screwed into place. The end slats are mortised into the arms and the top edge of the end rails.

A detail of the seat support is also given. These are screwed into the end rails from the inside. The slats are nailed onto these pieces, leaving a slight crack between each slat.

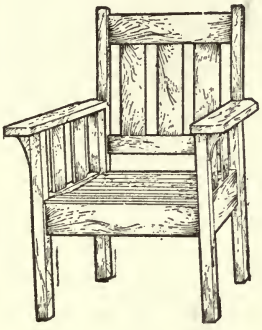
Regarding a waterproof finish for the swing. A wax and shellac finish will serve, but a spar varnish over properly filled grain is much better. Detailed, this is applied as follows:

1st. One coat of oil stain, of the chosen color, carefully wiped off as applied. Let it stand twenty-four hours.

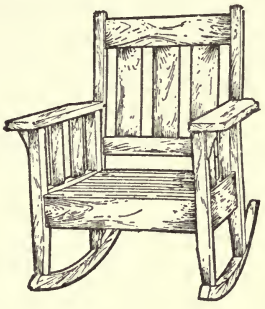
2nd. One coat of paste wood filler, thinned out with benzine and rubbed into the grain with the finger tips. Wipe

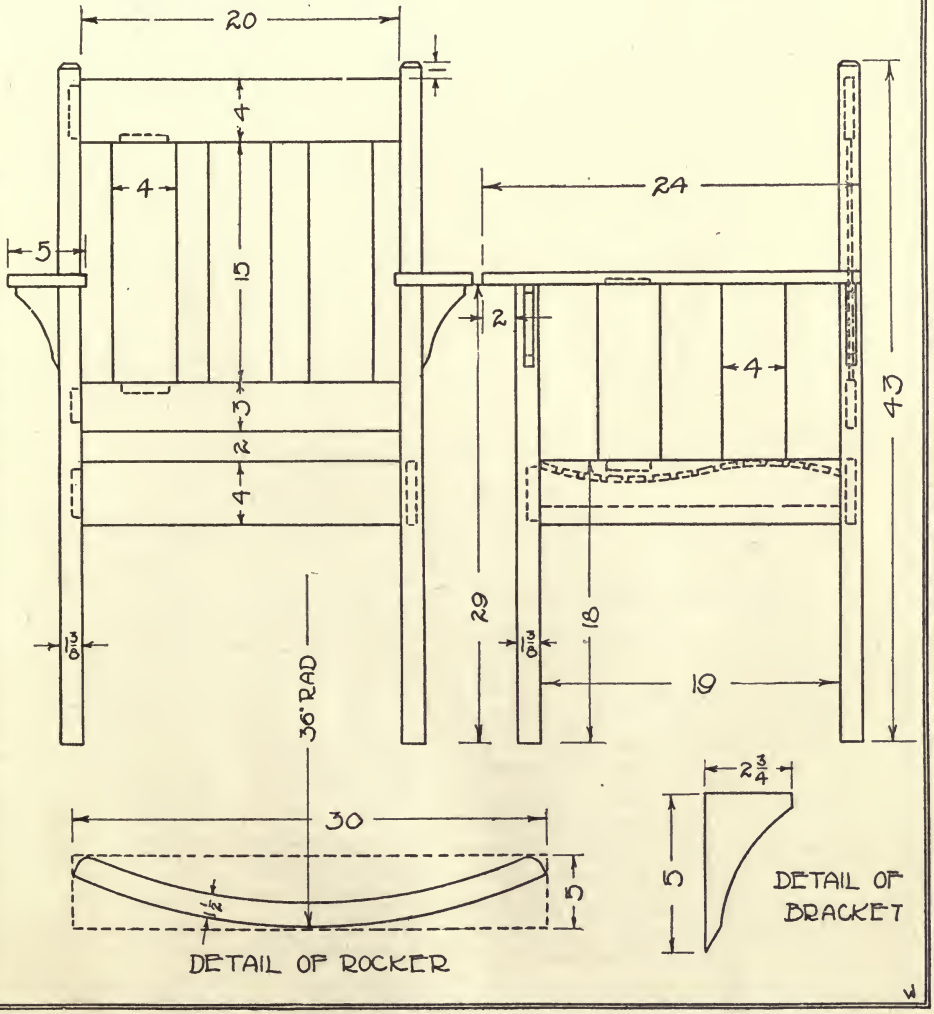


The Various Details of the Porch Swing as Well as its Appearance When Completed.



COTTAGE CHAIRS





The Various Details of the Chair and Rocking Chair as Well as the Pieces as They Appear When Completed

off with dry cloth or waste. Let stand twenty-four hours.

3rd. One coat shellac. Let stand about three hours and rub down with fine sandpaper.

4th. Repeat 3rd step.

5th. One coat best spar varnish, applied *all over* the swing. After thirty-six hours rub down with No. oo steel wool.

6th. Second coat of varnish, rubbed down after forty-eight hours with pumice stone and water.

This finish will undoubtedly be satisfactory, but if a great gloss is desired, apply another coat of varnish and rub it down in two or three days with pumice stone and oil.

If a waxed finish is desired, after the 4th step, apply a thick coat of prepared wax. Allow it to stand over night, and rub it to a good polish in the morning with a dry cloth.

COTTAGE CHAIRS.

The arm chair and the rocker illustrated are so very simple that one drawing will suffice for both. For the arm chair purchase the following stock, finished sizes:

2 pcs. 1⅜″ x 1⅜″ x 43″, back legs.
2 pcs. 1⅜″ x 1⅜″ x 29″, front legs.
3 pcs. ⅞″ x 4″ x 22″, front and back rails.
1 pc. ⅞″ x 3″ x 22″, back rail.
2 pcs. ⅞″ x 4″ x 21″, side rails.
2 pcs. ⅞″ x 5″ x 24″, arms.
2 pcs. ⅞″ x 2½″ x 19″, seat supports.
3 pcs. ½″ x 4″ x 16″, back slats.
4 pcs. ½″ x 4″ x 12″, end slats.
9 pcs. ½″ x 1½″ x 21″, seat slats.
1 pc. ⅞″ x 2½″ x 21″, brackets.

For the rocker the only changes will be to make the back legs 38″ long and the front 24″. The rockers will be made from two pieces 1⅜″ thick, 5″ wide and 30″ long.

The chair construction is identical with that of the porch swing in its main details. The brackets will be made of wood and screwed into place.

The legs for the rocker, as suggested above, will be five inches shorter than the arm chair legs. The rockers will be screwed onto the legs with long flat head screws.

If possible, it would be a very good idea to have the rockers sawed on a band saw at the mill, as it is a very long and tedious job to do it by hand.

The same finish is suggested for the chairs as was detailed for the swing.

A WINTER PORT FOR RUSSIA

Without question an important part of Russia's interest in the war is due to her ambition for a year-round outlet to the ocean. She has fought to win Constantinople years ago and been balked and even now it does not seem at all certain that she will be rewarded with entire control of the Dardanelles. Of course, Archangel is her port on the Arctic but it is ice-bound half the year with the drifting ice blown down from Nova Zembla by northeast winds.

Russia is now assured that she has the key to the situation in the development of a great harbor at Kola near the Norwegian boundary. Here is a bay running about twenty-seven miles inland from the Arctic Ocean and about three miles in width with a depth of two hundred and forty feet. Although much farther north than the port of Archangel on the White Sea (and west) this bay is open all year. The Gulf Stream sweeps around the end of Norway and keeps this section of the coast free from ice. In fact, the temperature is 30 degrees Fahrenheit warmer than the forests of Lapland to the south. A branch of the Petrograd-Archangel railway could reach this bay without any insurmountable engineering difficulties for the tundra swamps are underlaid with granite. Had this port been developed years ago the history of the world might have been changed.

MAKING *the* CABIN CRUISER COMFORTABLE

BY PETER SUAU

WHILE the average cabin cruiser is equipped with numerous accessories for extending the maximum comfort to its passengers, still there are many additional pieces of equipment that may be installed in order to render the craft most suitable for long cruises. The average short trip requiring but a few hours or even a day's stay on board the cruiser does not call for any luxuries, but it is on voyages of several days' duration that all the comforts of home are longed for.

THE cabin cruiser — no matter how small it may be—can be made a real home. One of the essentials in making the cabin cruiser homelike is to provide a place for everything and always have everything in its place. Otherwise chaos reigns. While the following suggestions are for the most part easily followed out by the average handyman and at a slight cost, they will contribute materially towards securing the degree of comfort that is associated with one's home.

There should always be a few extra sweaters or even old clothes for wear on board the cruiser, for a change of clothes is conducive to the fullest enjoyment of a cruise. But the clothes must be dry. If they are stowed away in the lockers beneath the seats or berths from one week to the next, they are sure to become damp. Furthermore, any clothing that may be brought on board the boat will, in a short time, be unfit for wear.

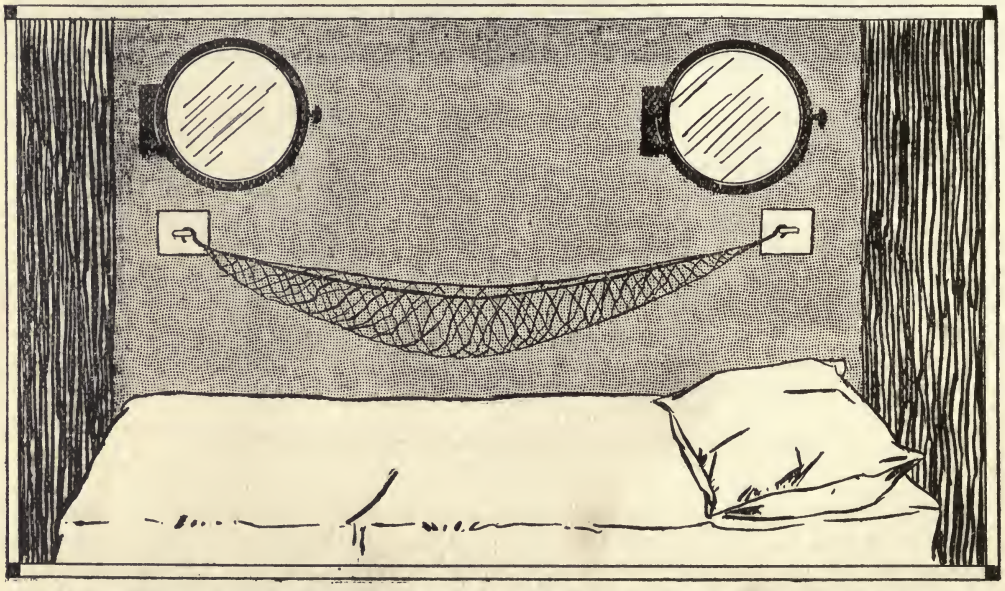
The foregoing disadvantages may be readily overcome. There is always space over a berth along the side of the boat. This can be best utilized by hanging up a small hammock, such as can be purchased for a few cents. It is known as a children's or baby's hammock, and measures about five feet long. Such a hammock makes an excellent receptacle for the clothing, and is not in the way at any time. A simple and very effective way of attaching it to the side of the boat is with a ring plate at each end. The ring plate may be fastened to the wall by means of four screws. The hammock can be attached to these rings with small S hooks. The ring plates are very

strong and will not pull out as screw-eyes would.

Every ship must have its clock, but to the moderate purse the regular ship clock is rather an extravagance. A very neat clock can be constructed at little expense, yet in appearance it can be made the equal of a very expensive ship clock. The sole difference is that the clock will not strike the ship bells.

The only materials for the clock are an old steam gauge and an ordinary cheap alarm clock. The brass steam gauge can be picked up in any second-hand junk shop for a very few cents, and the interior mechanism of the gauge and dial removed, leaving a shell for the alarm clock. The back of the gauge in most cases is threaded and screws to the body, so that the back can be taken off and two small holes bored to take a couple of wood screws of sufficient length to attach it to a wall of the boat. Remove the feet and usual top ring from the clock and place it inside the case of the gauge. A hole bored through the top with a screw to fit where the small ring on the top has been removed will hold the clock in place. This permits the whole to be unscrewed from the back for winding and setting the clock. With the brass well polished and given a coat of transparent lacquer, the arrangement affords a very attractive addition to the cabin of the boat.

With room at a premium on board a cruiser, the equipment of the galley is usually overlooked, and the space saved given over to fancy cushions, extra sitting room or something of this character, whereas in reality, whether for a short trip or a long cruise, the galley is one of the most important sections of the boat. A good stove is an essential, and its choice is very difficult. There are a number of types on the market, but for a type that will give all-around satisfaction and is inexpensive to run, the blue flame kerosene stove is probably the most satisfactory. The oil is held in a tank which forms the base of the stove. The stove has two burners, and it is surprising to learn of the excellent meals that can be prepared with it by a little manipulation and ingenuity.



A Small, Inexpensive Hammock, Such as are Sold for the Use of Children, Forms an Excellent Holder for Clothing when Fastened to the Wall of the Cabin.

An equipment of noteworthy compactness and suitable for cooking food for five persons can be made up as follows:

One 10" frying pan.
One 2-qt. coffee pot.

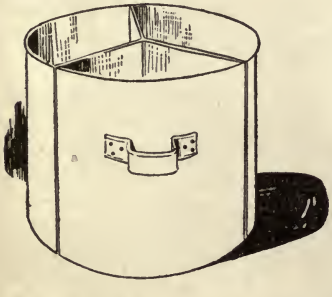
Three triangular pots which go on one burner at the same time, having the same effect as a 10" pot.

One large pot into which above three pots will nest.

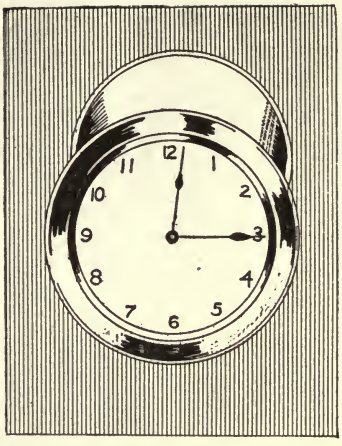
With a limited number of cooking utensils the most elaborate meals can be prepared. For instance, the three-pot utensil permits of cooking three entirely different dishes on one burner. Without it great inconvenience would be felt for lack of cooking surface on the stove. The three-pot utensil is of aluminum, and although more expensive as to the initial cost, it will be found more practicable in the long run, because it will not rust. Compare this to an ordinary iron frying pan which rusts in a day or two with the dampness on a boat and requires considerable scouring before it can be used again. It must be borne in mind, however, that salt water attacks aluminum very readily, so that if the first washing of these pots and pans is in salt water they should be rinsed in fresh water before being put away. A small oven can also be secured, and in combination with the stove makes a complete outfit.

To minimize the worries of housekeeping, paper plates will be found invaluable. In serving soft boiled eggs paraffine paper cups of a similar kind to those supplied at the public drinking fountains can be used, for it is well known that egg is disagreeable to wash from china or glassware. A paraffine cup, set into a glass which holds it firmly, affords a very appetizing way to serve eggs.

Everything that is not tied down hard and fast aboard a cruiser receives a bad mixup at one time or another, and if china or glassware is included it is rather a disastrous mess that one will find upon opening the locker. Glasses should all be kept in racks. A small and attractive rack is shown in one of the accompanying sketches and can be made very easily. The only tools required for making the glass rack are a hammer, a screwdriver, an expansive bit, a ¼" chisel, a small plane and a small, fine-toothed saw.



This Utensil of Aluminum Permits of Cooking Three Kinds of Food at One Time.



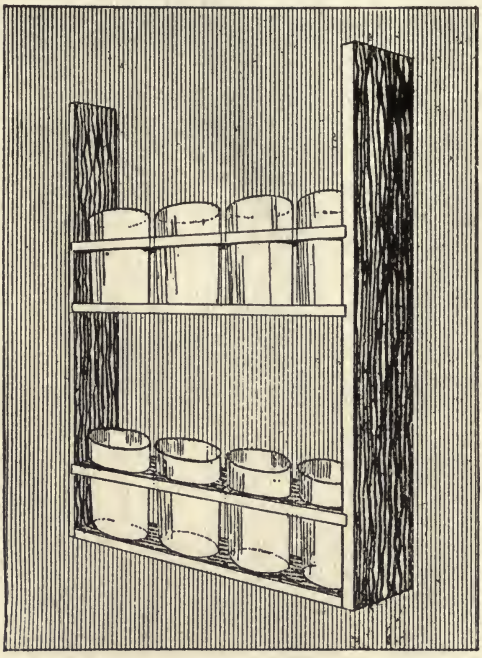
By the Ingenious Combining of an Alarm Clock and Steam Gauge Case, A Ship's Clock is Obtained.

The following materials will be required for the glass rack to hold eight glasses:

Two pieces 12 x 3¼ x ⅜ inches.
One piece 12¾ x 3¼ x⅜ inches.
Three pieces 13⅛ x 3¼ x ¼ inches.
Two pieces 13½ x 1 x ¼ inches.

Since the quantity of lumber required is very small, it is advisable to use mahogany. One of the accompanying sketches shows the general construction of the rack. The various pieces of wood should be put together with ¾-inch finishing nails with the single exception of the two back strips, which may be held by small brass screws. The rack may be finished by sandpapering it thoroughly and giving it a coat of orange shellac, followed by another sandpapering and a final finish of one or two coats of varnish.

Sugar and salt are the two foodstuffs which are most affected by the dampness when carried on shipboard. A very simple way of preserving them indefinitely is to produce about half a dozen preserve jars fitted with metal screw tops and provided with rubber washers for holding the sugar and salt supply, as well as other foodstuffs. Jars of three to three and one-quarter inches in diameter and of one quart capacity will



Glass Tumblers Held in a Simple Rack are Safe from Breakage when the Cabin Cruiser Begins to Roll.

probably serve the purpose best. In order to prevent these jars from rolling about when stored in a locker, a small rack may be constructed as follows:

Secure a piece of wood one-quarter inch thick and of such length as to accommodate as many jars as are to be held in place. At suitable intervals holes are bored with the expansive bit in order to hold the jars. The board is placed about three inches above the shelf of a locker so that the jars may be dropped through the holes and will rest on the shelf.

For the benefit of the handyman who is not already familiar with the handling of an expansive bit, it is well to add a word of caution. In using one of these tools the hole should be bored halfway through or until the point of the bit is seen on the other side of the board. The board is then turned over and a hole bored from the other side, using the small hole as a guide. By this means a perfect hole is made with smooth edges.

The foregoing suggestions for making the cabin cruiser comfortable are but a few, and with the experience the boat owner secures in building and securing the different things described, it is more than probable that other equally or even more important ideas will suggest themselves.

SODIUM SALTS AS FERTILIZERS

It has been shown by the work of investigators in America and Europe that sodium salts will, in part, replace potassium salts, especially with certain crops.

Soda can never entirely replace potash, but certain classes of plants take up more potash than they actually need, if an excess is present in the soil. If available soda is present it seems to be substituted for some of the potash without injury to the plant.

Of course, the soda also serves as a neutralizing agent to combine with the organic acids produced in the soil. Sodium salts are particularly helpful to such crops as turnips, beets and radishes and probably for cabbage. On the whole, it may be stated that some of the root crops like beets, turnips and wurzels make a greater use of soda than do cereals.

NAVY TAKES OVER SAYVILLE WIRELESS STATION

After a series of conferences and controversies covering a period of nearly one year, the United States Naval authorities have taken complete charge of the German wireless station at Sayville, L. I. The charge was made that unneutral dispatches cunningly concealed within apparently innocent commercial and diplomatic messages were being transmitted to the station at Nauen.

Some Useful Picture-Framing Hints

By Charles A. King

BEFORE a picture is measured for its frame, its opposite sides should be parallel and its adjoining sides at right angles. The "sight" of the frame, or its extreme inside dimensions, should be ⅜-inch smaller than the picture, thus a picture 14 inches wide and 20 inches long would require a frame 13⅝ x 19⅝ inches inside, or sight dimensions.

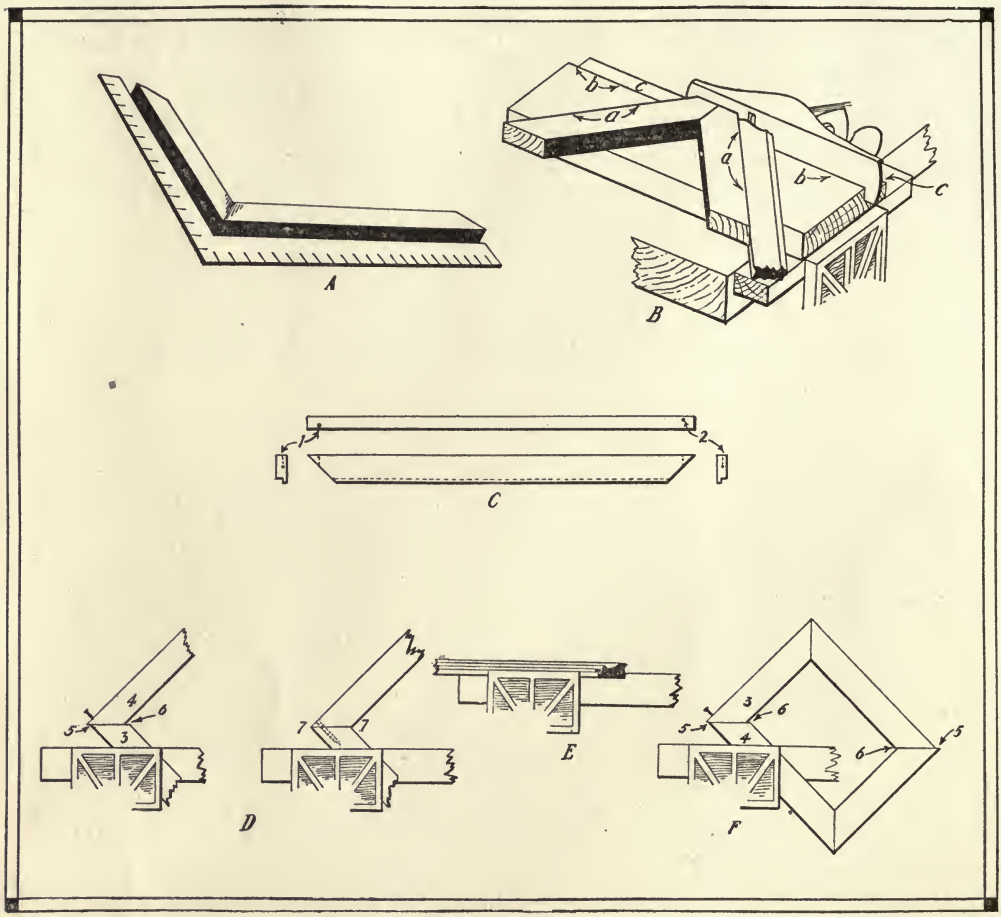
An iron miter box is more satisfactory than a wooden one for sawing the miters, though accurate work may be done by the latter. Often, after using either, the joint can be improved by block planing, so that the surfaces of the miters will be in perfect contact when the back of each moulding lies closely upon some flat surface and the outside edges rest against the inside edges of a steel square, as shown at *A*.

If satisfactory results cannot be obtained by this method, a "shooting board," shown at *B*, may be used; the edges *a a* must be at right angles to each other and at angles of 45° to the edge *b*. The two angles, *a b*, are necessary to permit the opposite miters of a moulding to be planed. The edge of the plane iron should be straight, instead of slightly rounded as usual, and adjusted to cut a thin shaving of uniform thickness from the entire surface of the miter.

After the joints have been fitted and the opposite pieces of moulding made the same length, holes should be bored from the back edge through the mitered ends of each piece, as at *C*, hole 1 being placed near the face, and 2 near the back.

There are two methods of placing mouldings in a vise to nail them; a flat, unfinished piece may be held as indicated at *D*, while the method illustrated at *E* is better adapted to one with a finished or moulded face, as it will not be marred by the jaws of the vise. The inexperienced worker should practice upon small pieces before attempting to fasten the frame together, as the principal difficulty lies not so much in the fitting of the joints as in the nailing. The short piece 3 should be placed in the vise, and the long piece 4 nailed upon it as at *D*. The nail should be placed in the hole 1 near the end of 4, and the mitered end lightly touched with glue, and placed with its edges about ⅛-inch beyond those of 3, as at 5 6. The backs of the pieces must coincide so that when the nail is driven through 4 into 3 the sliding of 4 will permit the face members of the mouldings to intersect, as at 7 of *D*. Piece 4 may be held with one hand while the nail is being driven with the other; a firm pressure, perpendicular to the surface of the miter, must be applied, or the moulding will slip.

One nail through 4 into 3 should hold the pieces in place while their positions are carefully reversed, in doing which care must be used to avoid moving the pieces by each other, and a nail driven through 3 into 4. Unless the foregoing task is done carefully, the joint may be started. After the other two pieces have been nailed together by the same method they must each be handled as one piece,



The Tools Required for the Making of Frames, as well as Details of the Work in the Various Stages.

and both fastened together, as at *F*, though a finished moulding should be held in the vise as at *E*. This is the most difficult part of the entire frame, as only one joint can be nailed at a time, which necessitates turning the entire frame while one joint is unsecured, and the other has but one nail in it. In nailing the first joint an allowance for sliding should be made.

The frame should be allowed to stand until the glue has hardened, after which the corners may be trimmed, the bare wood touched with stain, and the frame repolished with a light application of wax; if made of unfinished wood, it should be stained and finished at this time.

Lay the face of the frame upon a piece of cloth to prevent its being marred, and measure it for the glass. If its sight is less than 20 inches in its largest dimension, single strength glass will generally be satisfactory, but if larger, double strength may be necessary. The glass should be thoroughly cleaned, and unless it is perfectly straight it should be laid in the rabbet with its concave, or hollow side, toward the front of the frame. The picture should be laid face downward upon the glass, and a cushion, the same size as the picture, made of several sheets of smoothly folded paper, placed upon it to hold the picture smoothly against the glass, after which a back of thin wood or cardboard should be fitted closely

into the rabbet and fastened with small nails.

The back of the frame can be made dustproof by covering it with a strong piece of paper which should be cut about half an inch shorter and narrower than the extreme outside dimensions of the frame. After sponging it until it has become well dampened, spread cold glue evenly, but not thickly, for at least half an inch around its edges on one side. Its glued side should be laid upon the frame and rubbed or pressed with a case knife until it adheres closely. It will not be necessary to work all of the wrinkles out of the paper, for when it dries it will shrink and become tight and smooth.

The screw eyes by which the picture is to be hung should be placed one or two inches above the center of the frame so that its lower part will be the heavier and the frame will hang properly.

A SELF-WINDING ELECTRIC CLOCK.

AN electric clock is being sold in France which will run for a length of time determined by the life of the battery—usually from one to three years—without attention. The winding mechanism is so simple that it could be made by any amateur electrician. The clock movement is the same as that of any clock, so that the winding mechanism can be attached to any time piece.

Referring to the accompanying diagram, the armature *C* (the size of which varies according to the size of the movement) is placed between the two poles of a permanent magnet. The axis of this armature is terminated by an endless screw driving an ebonite wheel, *A*, which actuates a second larger wheel, *B*, rotating upon an axis which also carries the square spring shaft. The armature is placed in the circuit of a dry cell of suitable size, having its terminals connected to two metallic brush-carriers, *P* and *N*. The positive connection runs direct to the brush, but the negative connects with a wheel *G* of insulating material, upon one-half of the circumference of which is fastened the strip of silver plate *E*. The movements of this wheel are controlled by a finger *H*, causing a rotation of *G* sufficient to bring the strip *E* in contact with the spring of *N*. This finger is attached to the axis of one of the movement wheels which makes one revolution every two and one-half hours. During its rotation it comes in contact with another finger, *K*, which turns the wheel *G* an amount sufficient to close the

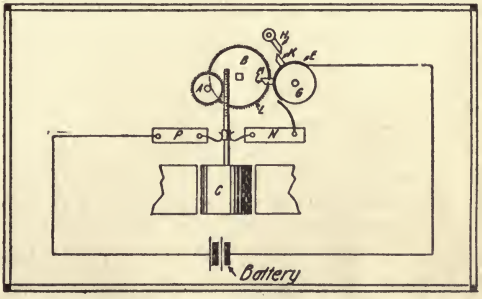


Diagram of the Working Parts of an Electric Clock that will Run for Three Years without Attention.

circuit. As soon as the motor turns, the wheel *B* also turns and continues until the pin *L* raises the arm *M* of the wheel *G*, and so breaks the circuit. In two and a half hours the finger *H* again gives the wheel *G* a fraction of a turn and closes the circuit. At this moment the pin *L* is above *M*, and consequently the circuit remains closed during the time of one revolution of the wheel *B*.

Several of these clocks, according to *La Nature*, have been placed upon the cars of the Paris street railways, and, notwithstanding the continuous vibration and shock to which they are subjected, have been recording the time faithfully for a considerable period without any attention whatever.—J. H. BLAKEY.

MASSACHUSETT'S NEW ELECTRICIAN'S LAW

A law of great importance to residents of Massachusetts became effective July first. The most important clause in this act is as follows, "Except as hereinafter provided, no person, firm or corporation shall, after the first day of September, nineteen hundred and fifteen, enter into, engage in, or work at the business of installing wires, conduits, apparatus, fixtures or other appliances for carrying or using electricity for light, heat or power purposes in this commonwealth, either as a master or employing electrician or as a journeyman electrician, unless such person, firm or corporation shall have received a license or certificate therefor, issued by the board provided for in section two of this act, and in accordance with the provisions hereinafter set forth."

This means that unless he has a license no person may repair a fixture of any sort, install or repair any wiring—with a few minor exceptions—or do any power wiring incident to lathe motors, wireless telegraph sets, etc.

A commission is formed to carry out the provisions of this act and it is expected that this commission will from time to time hand down decisions regarding the application of the act so as to make it work a little less hardship than it now does. While in its essence it is a desirable measure in that it eliminates a very undesirable class of person who is accustomed to do work of a very questionable character, it appears as if the act was going to restrict, in many cases, the growth of the industry. It is already rumored that the commission will issue a ruling forbidding electrical houses from giving net rates to persons or companies not holding a license.

Examinations will be held at frequent intervals at Boston, twice a year at five other appointed places, and at any other times or places the examiners may deem necessary. A fee of $25.00 is required to take a master's examination, and $1.00 for a journeyman's examination. In order to perform the work one must have a journeyman's license, and in order to contract for the work it is necessary to have a master's license. Thus to install an electric light fixture for one's self one need only have a $1.00 license, but to do the work for a neighbor one must have both licenses. Any person actively engaged in electrical wiring for a livelihood for the five consecutive years next preceding his date of application will be issued a license without examination. The license is renewable each year upon the payment of a fee of fifty cents for a journeyman's license and of $15.00 for a master's license.

There are certain exceptions to this act, the most important of which are the exemption of public service corporation employees doing outside and meter installation work, certain temporary theatre work, elevator repair work, incorporated companies engaged in the transmission of intelligence by signalling with electricity, and apprentices working under the direction of a licensed electrician. A maximum penalty of $100.00 is imposed for the first offence of the violation of the provisions of the act. Subsequent violations by the same person are subject to a maximum penalty of $500.00.

A complete copy of the act may be obtained by addressing the Secretary of the Commonwealth, 331 State House, Boston, and asking for a copy of the "Act Relative to the Registration of Persons, Firms and Corporations Designing to Install Wires or Apparatus for Electric Light, Heat or Power Purposes."

NEW EXPLOSIVE FOR SUBMARINE TORPEDOES

A new explosive for use in submarine boat torpedoes which is said to be immeasurably more terrific in its destructive power than the explosives now in general use has recently been perfected by an inventor connected with a submarine construction company of this country. The new explosive is used in connection with mechanical devices upon which patents are now pending. Although the Allies have offered to buy the patents, arrangements are already being made whereby the United States navy will secure them.

Electricity to Be Used in Farming

By Albert Marple

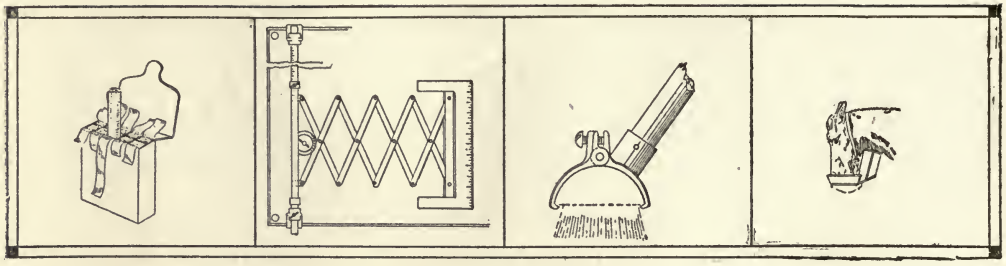
A PROCESS has just been announced by W. J. Anson, an inventor of Southern California, whereby it is claimed that electricity may now be used in connection with farming in a manner which has up to this time probably never been even suggested. In a word, by this new system electric current is used in the sub-irrigation of the soil, it stimulates and accelerates plant growth, while at the same time it protects the trees against extreme heat and winter frosts. This inventor has been working on the system for years and has had such wonderful results that prominent horticulturists and agriculturists are taking notice and are making a thorough investigation.

During the past year Mr. Anson has been operating in the San Fernando Valley. He said recently: "During my experiments in the San Fernando Valley I proved to my entire satisfaction the merits of my system as a protection from frost. In a small tract in which I had ascertained the character of the soil to be identical throughout, I had one acre in which my process was used, one acre under dry farming and part of an acre under surface irrigation. Seeds of the same kind were planted in each piece. The test came unexpectedly during a heavy frost in my section. The plants in the ground that was treated by my process revealed the hardiest growth of all, and were the only ones that were alive and thriving after the frost. Of the four palms in our front yard, the one treated by my new method was the only one that was not frozen down to the ground."

For this system the claim is made that it aerates the soil, the currents of air and electricity passing through the conduits causing a capillary attraction which reaches moisture from depths of from five to seven feet. It causes the soil to retain its moisture so that it remains in a pulverized state and does not bake, as is the case in ditch irrigation. It is claimed that with this system one gallon of water will do the work of forty gallons used under ordinary conditions. The water is carried to the place where it is needed. As this system is almost entirely under-ground it saves the space ordinarily taken up by ditches.

This system is simple both in installation and operation. Tile conduits are laid in the soil at depths ranging from fourteen to sixteen inches, these being about ten feet apart. Galvanized wiring is run through each conduit, the current that works these various benefits being derived from a feed line extending across the end of the orchard or garden plot. Where the process is used in groves the plan followed is that of having a positive and negative current on either side of a row of trees, with an upright tile outlet at each tree; there being, at the top of each of these outlets, a resistance coil. In winter the coils are heated by electricity, the current being governed by a thermometer which automatically opens a switch the moment the mercury goes below a given point. This automatic regulation of current will create in the coil sufficient heat to keep the atmosphere around the trees at a safe temperature.

The discovery promises to revolutionize farming, especially in those sections where irrigation is necessary.



Recent Novel Patents

Convenient Cigarette Box

Probably the latest luxury for the growing army of American cigarette smokers is a compact box from which the cigarettes are withdrawn by means of paper tabs. The tabs extend to the bottom of the box, under the cigarettes, and up to the opposite side, where they are pasted.

Novel Drafting Instrument

An instrument which is claimed to be able to perform a variety of drafting gymnastics has recently been invented by a Los Angeles man. It consists of a rigid support attached to the drafting board and a collapsible frame resembling in operation the collapsible doors at the ends of Pullman trains. This frame extends outwards to a considerable distance over the drafting board surface and, because of its peculiar construction, always remains parallel to the point at which it is originally fixed. A ruling device is attached to the end of the collapsible support.

Ingenious Brush Holder

A Philadelphian has invented a brush clamping device which is ingenious in many respects. The brush holder comprises a pair of duplicate clamps which are pivoted together and forced into close contact with the bristles by means of a machine screw. A socket is provided which projects from one clamp and into which the brush handle is inserted; a screw hole is provided for fastening the handle to the socket. The jaws of this clamp are curved, to accommodate various brushes.

New Food Bag for Horses

The old idea in feeding bags for horses, no matter what were its humanitarian intentions, was more or less of a de-appetizer for the animal. A new bag for feeding grain to horses has been brought out by an inventor in Newark and has advantages manifestly superior to the old type. It consists of a pan having folding sides and ends and a metallic hopper which allows the grain to run automatically into the pan as the horse eats.

Cigarette and Match Holder

Anything to do with cigarettes is interesting to the American public, because the American public, according to very conservative estimates, smokes upwards of one hundred million cigarettes a day, and that estimate is increasing very rapidly. A really useful and ingenious cigarette appliance will bring more royalties to an inventor than an automobile invention. One of the latest "cigarette patents" issued was based on a combination cigarette and match holder. The matches are contained under the flap of the cigarette box. A scratching surface is provided.

Holder for Pocket Lights

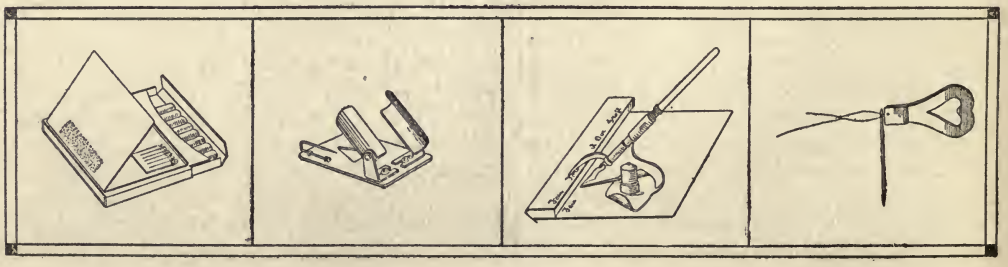
No other field of electrical development has seen such a rapid increase in the number and diversity of applications as that taken by the seemingly commonplace electric pocket flashlight. Within the past few years it has improved from a toy and an uncertain speculation to a thoroughly reliable and highly efficient tool. One of the most recent improvements for the benefit of the user is an adjustable holder into which the pocket lamp may be placed and held in any position while work in the darkness is going on.

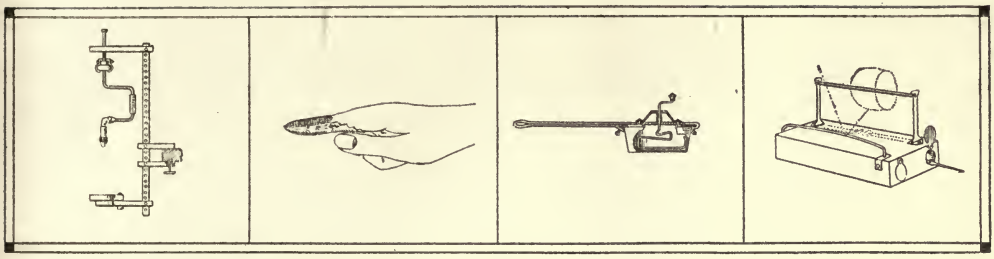
A Copying Device

From a small settlement in the Canadian Northwest comes a clever idea in a hand writing device which the patent authorities at Washington consider ingenious enough to warrant the granting of a United States patent. The writing to be copied is placed on a ruler-like support above the pen. A curved tracing point follows the curves and angles of the writing.

A Needle-Threader

A needle-threading device which, from the standpoint of simplicity of construction and operation, is a vast improvement over the countless needle-threading machines brought out since the needle was first thought of, is the subject of a patent recently granted to a New York inventor. A thin wire loop is attached at one end to a small handle. The opposite end of the loop terminated in a sharp angle.





A Drill Press

A drill press which will be of interest to the amateur mechanic who is handicapped by lack of funds is the subject of a patent granted to an inventor in Michigan. The press consists of an upright standard in which a number of holes spaced equidistantly are bored. Bolts passing through the holes into a clamp hold the press in place on the workbench. An arm projects at right angles from the top of the standard and to it is attached a screw, at the lower end of which is a clamp for holding the handle of the drill. The drill is an ordinary brace-and-bit.

Combination Clamp

Two young men in Illinois have been granted a patent upon a combination clamp for use about the workshop or garage. It consists of a stout bar with depressions cut regularly along one side and terminating at one end in a curved up foot. The remainder of the clamp, which, with the exception of the screws, is cast in one piece, moves up and down the main bar, one projection fitting into the depressions. Two distinct clamping operations, neither of which interferes with the other, are possible.

Toothbrush on Finger Tip

Tooth brushes of every conceivable shape and design have been patented since the antiseptic properties of that implement were first exploited by the dental and medical professions some years ago. One of the most unique ideas in this direction has just been granted a patent. A man from Texas, where compactness in the minor luxuries is still at par, is the inventor. The new tooth brush resembles the glove finger tip used in protecting injured fingers.

Wire Puller

A wire pulling machine which has advantages over those now on the market has just been patented. It embodies a combined ratchet, a pull in one direction locking the wire and spur in a sliding bar. A handle engages another spur in a sliding bar. A hook is provided on a bar to which the handle is pivoted. The handle is a powerful lever.

Mixes Cakes and Frostings

A pan for mixing cakes and frostings is the subject of a patent recently granted to a Wisconsin inventor. The pan, except for its unusually long handle, outwardly resembles the conventional household coffee mill. A knobbed handle projects from the top and is braced by iron arms which go to the sides. Within the pan, the handle is bent in a series of convolutions of a design best adapted for the purpose of mixing frostings thoroughly.

Turns Leaves of Music Portfolios

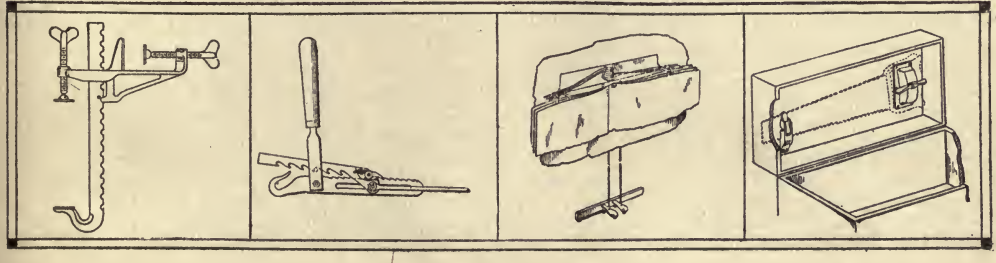
Pianists appreciate the embarrassment which arises when suddenly, in the midst of a difficult selection, a draught of air causes the sheets of music to fly over and the exasperated musician to lose his place. This unpleasantness is eliminated in an ingenious little device, invented by a man in Indiana, which turns the pages over as the pianist wills. Thin levers reach out to the individual leaves of the music book, and when the pianist desires to turn over a page, he or she merely presses a pedal. Pressing another pedal, by an arrangment of cogs, turns the leaves in the reverse direction.

Crochet Thread Holder

Now that the craze of knitting various articles of usefulness for intrenched soldiers is at its height, the social world should be interested in a patent which has recently been granted to an inventor in the District of Columbia for crocheting. The device, which appears to be somewhat complicated to the layman, consists of a base, spindle supporting uprights and a bow-shaped guide. The bow-shaped guide has a length equal to that of the bulk which moves along the spindle, thereby permitting the thread as it unwinds an unhampered movement. The bow-shaped guide prevents the bulk from moving against the spindle supports.

Saw Holder

A duplex clamp for holding a saw in place in the top of a tool chest has been brought out by a Pennsylvania inventor. The handle of the saw is clamped in place by a block and winged screw, while the opposite end is held by a spring snap. This holder effectively prevents the saw teeth from coming in contact with other tools and thereby suffering injury. It also makes certain that the saw can be found, when required, in its proper place.



Questions and Answers

This department will appear regularly in THE WORLD'S ADVANCE, subject to following regulations: The questions must be legibly written with typewriter or in ink, on one side of the sheet. Each question must be definite and cover but one point of the subject under consideration, although a letter can contain more than one question. On the 10th of the second month preceding the date of issue of the magazine all the questions on hand will be considered and those which are put in the most intelligent manner and of widest general interest will be selected for publication in such issue, the number being governed by the space available. All other questions will be returned to the writers with a statement of the price for which they will be answered by letter. Return postage must be enclosed with each letter containing questions, and the letters must be addressed to the Questions and Answers Department and contain nothing relative to other departments of the magazine.

DETECTORS.

(14) R. O. S., Williamstown, Pa., asks:

Q. 1.—What size of storage battery is best to use with a one-inch Bull Dog spark coil?

A. 1.—We are not familiar with this particular type of coil, but a 6-volt 60-ampere-hour battery is usually used for a one-inch coil.

Q. 2.—Is the Radioson detector very sensitive and reliable? What stations use it? Is it better than the Crystaloi?

A. 2.—We have never tried the type of detector mentioned. Better write the makers direct and find out what they have to say. You can also ask them what voltage is necessary to be used with their Bull Dog coil. We have tried the Crystaloi detector and have found it very satisfactory for all-around work.

LIGHT AND POWER FROM BATTERIES.

(15) G. L., Clifton, N. J., asks:

Q. 1.—Is it practicable to install a small electric lighting outfit, for miniature lamps, door bells, etc., in a house remote from a regular supply?

A. 1.—Yes, very acceptable and economical installations can be made by use of a few storage cells permanently wired to gravity cells. A satisfactory number of storage cells will be three, for this being common with automobile practice, you will be able to utilize standard appliances. You can make the entire outfit yourself. For storage cells you can make plates of the Planté sort by following the description in the first part of Watson's book on Storage Batteries, the material being ordinary roofing lead. Electrical formation can be hastened by modifying the arrangement a little, first separating the strips with toothpicks and filling the intervening space with litharge or red lead, then removing the sticks and fastening the plates together with soft rubber bands. Though these latter will not be very long lived, they will endure until the chemical changes have become well established. Make a dozen gravity cells, using 6" x 8" glass jars, perhaps by removing the tops from bottles. You can cast your own zincs in foundry sand. In order to prevent the zinc salts from creeping over the edges of the jars and to avoid loss from evaporation, you can well adopt the expedient of pouring on top of the solution a layer of paraffin oil, say ¼" deep. Also, after the right specific gravity of storage battery solution has been attained, oil in these cells is highly to be recommended. In a warm attic, where you propose to locate the equipment, this is almost your only method of sure operation. We would advise you, however, to put all the batteries in the cellar, and run the wires to the attic. A broken jar will not then result in ruined ceilings and carpets. In use, the gravity cells will regularly be charging the storage cells at a slow rate; when apparently drawing from the latter you will really be drawing from both sets in parallel, but almost all the current will come from the storage cells; their low internal resistance permitting them to follow the demand. You will be readily able, with such an equipment, to operate a fan or a sewing machine motor of suitable voltage.

AERIAL.

(16) R. A., Dexter, N. Y., asks:

Q. 1.—Would an umbrella aerial about 80 feet high having about 1,000 feet of wire on it be as efficient as a single wire flat-top aerial 2,000 feet long strung on telephone poles about 15 feet high?

A. 1.—Yes, the umbrella aerial would be far preferable.

Q. 2.—Please mention one or two wireless stations using a wavelength of 10,000 meters or more.

A. 2.—The Federal Company stations at South San Francisco and Heeia Point, Hawaii, are fitted out to use wavelengths of 10,000 and 12,000 meters. Tuckerton, N. J., also uses long wavelengths. The Marconi Company is building stations both on the Atlantic and Pacific coasts which will doubtless use wavelengths of this character.

SELENIUM CELL.

(17) A. J. H., Cleveland, Ohio, asks:

Q. 1.—Using a selenium cell with a telephone receiver and batteries, will the cell, acted on by light, cause the 'phone to respond to the variation in light? Will the pull of an electro-magnet vary as the intensity of the light on the cell?

A. 1.—We always regret to have to inform our readers that experimenting with selenium is not a very easy undertaking. At present selenium has only been successfully used in laboratories or under conditions approaching laboratory conditions, and then only by persons familiar with its properties. About all you will probably be able to record in the 'phones will be a click when the light strikes the cell. Work has been done on "light telephones," but, as far as we know, no practical results have been obtained. A spot of light has been caused to fall on a cell, which in turn operates a 'phone. The spot of light is reflected from a mirror controlled from some form of transmitter. In this way the telephones have been made to respond to sounds transmitted by means of light. As the current handled by the cell is very small the only type of electro-magnet that would be used is that of a sensitive telephone receiver or something of that type. Selenium cells are made to perform various "feats" by means of secondary circuits operated from relays controlled by the selenium cells.

TRANSFORMER HEATING.

(18) K. T., Nicholson, Pa., asks:

Q. 1.—How long should a step-up transformer for wireless work stand the current on without heating to such an extent as to make it necessary to shut the current off?

A. 1.—This all depends on the quality of the transformer. As such a transformer is designed only for intermittent work, a higher heating loss can be permitted than for a power transformer which must remain in the circuit all of the time. We have tested a well-known make of Type E transformer and found that it is capable of running several hours without becoming heated to a dangerous temperature. The secondaries of some open-core transformers heat very badly even on short runs.

UNIVERSAL MOTORS.

(19) F. A. A., Silver City, N. M., asks:

Q. 1.—Is it possible to change a direct-current motor so that it will operate on alternating currents?

A. 1.—Certain specially designed series motors will operate on both direct and alternating currents. Illustrations of this are seen in small sizes of household vacuum cleaners that operate at from 4,000 to 7,000 or more revolutions per minute. As induction motors on 60-cycle circuits, the maximum speed would be under 3,600 revolutions. A series motor is practically unlimited in speed. Sometimes these "a.c.-d.c." motors are called "universal" motors. As an illustration of the largest motors with such qualifications may be cited those operating on the N. Y., N. H. & H. R. R., between New York and New Haven, which receive direct currents while on the section involving the N. Y. Central's terminal, but alternating currents when on their own tracks. As a first necessity for such motors, the field magnet must be laminated, and since there is no suggestion that yours is of this sort, the case is hopeless.

CHANGING DIRECT-CURRENT MOTOR INTO ALTERNATING-CURRENT MOTOR.

(20) H. R. B., New Haven, Conn., asks:

Q. 1.—How can I change a direct-current fan motor to adapt it for use on a 60-cycle, 110-volt, 20-ampere alternating-current circuit? Motor has two field poles and a 12-slot armature.

A. 1.—Unless the field structure is laminated you cannot make the change. Even if field is of the desired sort, you may find that motor will hardly run, there being too many turns of wire to permit the necessary current to flow, for with alternating currents there is a choking effect in proportion to the square of the number of turns opposing the current in addition to ordinary resistances and counter electromotive forces. You would have to rewind with coarser wire, say three sizes larger than at present. You can even then expect lively sparking at the commutator. The 20-ampere designation is inappropriate, as the motor ought not to require more than one ampere.

ONE KW. TRANSFORMER.

(21) S. T., Reedsville, Pa., asks:

Q. 1.—I desire to build a one-kilowatt transformer to operate on 110 volts, 60-cycle supply. Would it be best to build a closed core or an open core transformer?

A. 1.—By all means build a closed core transformer. Its cost will be far less and its operation certainly more satisfactory than the open-core transformer.

Q. 2.—What size core should be used?

A. 2.—Sides 6¾" x 2". Use 170 pieces of 0.017" silicon steel per side. Ends 5¾" x 2". Same number and thickness as sides. Use lap method of jointing.

Q. 3.—What size wire should be placed on the primary?

A. 3.—Use 110 turns of No. 11 D. C. C. wire.

Q. 4.—What size and how many turns of enameled wire should be put on secondary?

A. 4.—The secondary will require 8,400 turns of No. 28. Unless you are familiar with transformer construction we would not advise you to attempt to build the transformer until you had read up considerable data on the subject.

MEETING THE DYESTUFF SHORTAGE

THE dependence of American textile manufacturers on the German coal tar dyes has placed some of our big industries in a difficult position. Though some importations still get through, they are inadequate. It is interesting to learn from official Government reports that American manufacturers of dyes are taking extremely active steps to establish new color works and enlarge existing plants. In the last few months the progress has been noteworthy.

Benzol is the starting point for most of the aniline dyes. It is a product of the distillation of coal tar, and in Germany coke ovens are built and operated so as to collect all the tar and finally the benzol. In America most of our coke ovens are of the old bee-hive type, which waste everything except the coke. This accounts for a shortage of one of the most important raw materials. However, much is being done to correct this waste. By-product coke ovens are becoming more common. One company has awarded contracts for 92 additional by-product coke ovens with complete equipment for benzol recovery, and expects to spend a million dollars on the plant. The Combria Steel Company, of Johnstown, Pa., has perfected its new battery of benzol scrubbers so as to secure a daily output of five tons of benzol, one ton of napthalene and the usual smaller amounts of toluol and xylol. To use this raw material the firm expects to erect at once a plant to manufacture dyestuffs. At first they will make only the staple dyes in greatest demand.

At Woodward, Alabama, a recovery plant is nearing completion that will furnish seven tons of benzol daily, and the new benzol plant of the Tennessee Coal and Iron Company will have a daily output of 13,000 gallons. Additional recovery plants are being built in connection with the coke works of the Republic Iron and Steel Company, of Youngstown, Ohio, of the Lackawanna Steel Company, at Buffalo, and of the Inland Steel Company, of Inland Harbor, Ind. The United States Steel Corporation in Indiana has in active operation a plant producing 12,000 gallons of benzol daily.

As to the actual manufacture of dyes, the Benzol Products Company has nearly completed an extensive plant at Marcus Hook, Pa., to be devoted to the manufacture of intermediate products on a large scale. They hope to produce most of the aniline oil and salts required by American color works. The W. Beckers Aniline & Chemical Company, of Brooklyn, has greatly widened the scope of its manufacturers, increasing its capital to $1,000,000. They will make a variety of aniline colors. A large chemical plant at Stamford, Conn., idle for two years, has been leased by a new company organized by Joseph Doelger, of New York. They will soon make on a large scale many aniline dyes never before produced in America. E. C. Klipstein, of New York, is making sulphur blacks which are in even greater demand in the hosiery industry than the famous aniline black.

Alizarin red and indigo blue are not planned for, yet they are the two most important coal tar dyes. There is a great increase in manufacture of vegetable dyes, such as logwood, fustic and orchil, white cochineal and mineral dyes, such as Prussian blue, chrome green, manganese brown, chrome yellow, and many others, will meet an increased demand.

LARGE BATTLESHIPS USE PANAMA CANAL

For the first time since its completion, the Panama Canal has been used for passing large United States battleships. On July sixteenth, the *Missouri, Ohio* and *Wisconsin,* carrying naval cadets from Annapolis to San Francisco, made the trip from the Atlantic to the Pacific.

The canal has been used by battleships before. The Peruvian gunboat, *Tentiente Rodriguez,* passed through the waterway about a year ago, and a flotilla of American submarine boats during February of this year navigated the canal during battle practice.

RADIO SECTION

Devoted to the Encouragement of Amateurs and Experimenters in the Field of Radio Communication.

An Improved Inductive Tuner

By Charles Horton

THE different types of couplers or receiving transformers now in common use may be roughly divided into classes as follows:

(1)—Couplers in which the adjustment in coupling is obtained by sliding the secondary within the primary.

(2)—Couplers in which the adjustment in coupling is obtained by rotating the secondary within the primary.

In the first class may be included three sub-types:

(*a*)—Those having slider adjustment on primary and slider adjustment on secondary.

(*b*)—Those having slider on primary and switch adjustment on secondary and

(*c*)—Those having switch adjustment on primary and switch adjustment on secondary.

In the second class may be included two sub-types, as follows:

(*a*)—Those having sliders and

(*b*)—Those having switches.

There are also a few other types which may be classed as imperfect types of any of the above, such as that type which has neither primary nor secondary adjustment, but relies entirely upon adjustable condensers for tuning.

All of the above types of couplers will be found to have one or more of the faults outlined below:

(1)—Presence of unused masses of wire giving rise to losses in efficiency.

(2)—Imperfect contacts causing resistance and unreliability.

(3)—Dead ends causing imperfect tuning qualities.

It will be evident after consideration that all of the above-mentioned types are subject to one or more of the faults enumerated, owing basically to the attempt to provide in one instrument a multitude of combinations in order to be able to receive on aerials of varying size from many stations working on various waves. Consequently, it will also be apparent that much higher efficiency is obtainable in the use of any particular aerial by the use of a coupler wound particularly for receiving from any particular station. Thus, if it were possible for each station to be provided with a number of specially wound couplers in addition to its adjustable coupler, accurate adjustment for any station with which it was in the habit of holding communication would be merely a matter of connecting its aerial and receiving circuits to the particular coupler provided. The author has long been of the opinion that just such an arrangement will be the final outcome of the present extensive experimentation in tuning, and has consequently designed an apparatus embodying this principle. This arrangement makes it possible to be receiving from, say, Nauen or Colon, or any other distant station, and by the mere throwing of a switch to connect with one's friend who is calling, see what he has to say, and by simply throwing the switch back again, to be in perfect tune as before with the distant station. The inestimable value of this apparatus will from the above be readily apparent. The chief objection to a set of this kind would naturally be the high cost, but in this set the cost is greatly reduced, and withal a wonderfully perfect receiving set pro-

vided, which has efficiency far greater than most receiving sets now available.

The set to be described is of the popular "panel" style, in which all the adjustments are placed upon the front side of a cabinet containing the various coils and other components. There is provided an ordinary receiving transformer with taps, and in addition twelve of the special couplers which will hereafter be known as "fixed" couplers. Upon the front face of the cabinet there is mounted, in addition to the tap switches for the receiving tuner and the variable condenser knobs, a special switch for cutting in any one of the fixed couplers, and also a compound switch for changing from the use of the receiving transformer to the fixed couplers. The switch for connecting any one of the fixed couplers is made double in order to insure that when any one of the couplers is in use there shall be absolutely no connection to any other coupler, as such connection might possibly set up oscillations in coils not intended to be used at the particular time considered. In order to accomplish this highly desirable severance of all connection with foreign circuits, switch points are provided for both ends of both secondary and primary coils of the fixed couplers. Finally, in order to prevent production of induced currents in any of the fixed couplers while one of them is in operation, the fixed couplers are arranged parallel to each other, this arrangement being devoid of inductive connection.

Referring now to the drawings, there is provided in Fig. 1 a perspective view of the completed instrument. In this view the arrangement of switches and adjustments is clearly shown on the front of the box, the handle for adjusting the secondary of the receiving transformer is shown on the right side of the same and the binding posts for the apparatus conveniently placed at the rear. The secondary is controlled by turning the knurled knob and the coupling by pull-

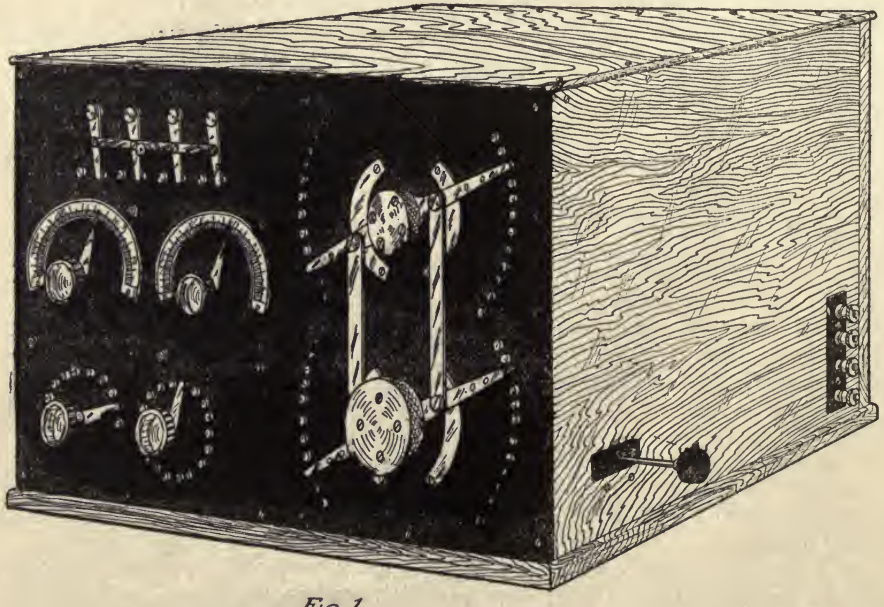


Fig. 1.

The Improved Inductive Tuner as it Appears when Completed.

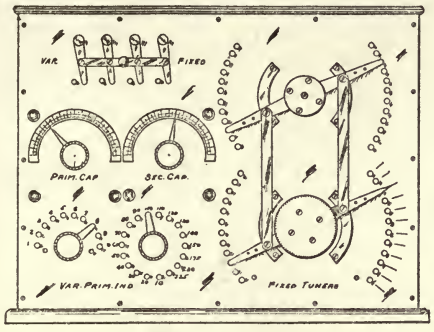


Fig. 2.

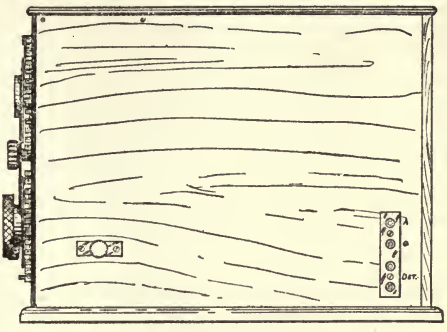


Fig. 3.

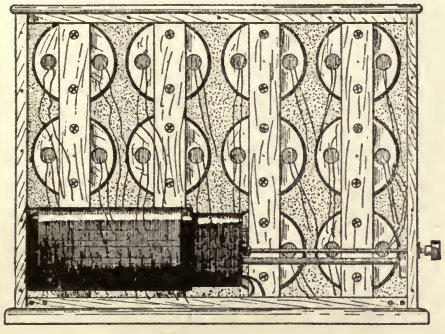


Fig. 4.

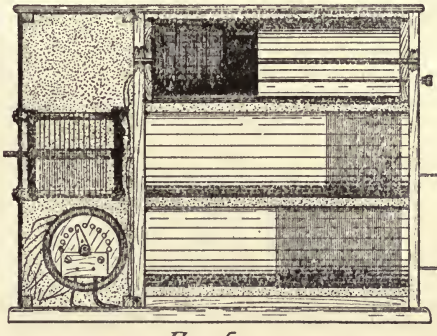


Fig. 5.

Views of the Exterior and Interior of the Inductive Tuner, showing the Location of the Different Parts.

ing the same to the right.

In Fig. 2 there is shown the front elevation of the instrument drawn to scale. It will be noted that the lower right hand arm of the fixed tuner switch is made to act as a pointer and lines are engraved on the front of the case corresponding to the different switch points. Adjacent to these lines may be placed the call letters of the different stations standardized in the instrument, and thus it will be an easy matter to pick out the tuner for any particular station.

Fig. 3 gives a side elevation of the cabinet, showing the secondary controlling handle and the binding posts.

Fig. 4 is a front elevation of the instrument with the front panel removed to show the interior arrangement. Here may be seen the receiving transformer mounted in the front part of the cabinet and also the twelve fixed tuners in the back of the same. The receiving transformer is mounted in an extremely simple though quite effective way. As will be seen, the primary coil of the same is supported entirely upon the left-hand end of the cabinet to which is screwed the wooden disk fastened in that end of the coil form. The secondary, as usual, slides backward and forward upon two metal rods which extend the full width of the cabinet and at the left-hand or primary end are supported in holes in the primary coil disk above mentioned, while at the right they are held in holes in a small piece of wood provided for the purpose and which is screwed to the right-hand end of the cabinet. The secondary switch mounted on the end of the secondary coil can also be seen, as well as the rod at its center passing

through the hard rubber bushing in the right-hand end of the cabinet to the controlling handle.

Fig. 5 is a side elevation of the cabinet showing the side removed. Here may be seen the three tiers of fixed couplers, the receiving transformer and also the method of mounting the adjustable condensers at the back of the front panel. The upper one of the fixed tuners is shown in section and discloses the secondary coil, the method of mounting the same within the primary and the means for adjusting the coupling. It may be stated here that it is intended to have the coupling in any of the fixed couplers made as loose as is consistent with clear reading, but in some cases, as in especially long distance work, coupling may have to be quite close. Consequently, the coupling could not be made invariable as by winding the primary and secondary windings side by side on the same form, which would be a simpler construction. It is intended that any change in inductance of the associated receiving circuits occasioned by the adjustment of coupling of these fixed couplers shall be compensated for by the adjustable condensers. The coupling, however, is intended to be seldom if ever changed when once standardized.

Before proceeding to a detailed discussion of the several parts comprising the instrument, it will be well to show how the fixed tuners are to be standardized. To this end it should be noted that the cabinet is to be completed in every way and ready for the reception of signals with the receiving transformer before the fixed tuners are wound. The apparatus is then connected up to the aerial and detector and a station accurately tuned in. In doing this both adjustable condensers are set with their rotating plates half in their stationary plates. When perfect resonance has been obtained, the exact number of turns in use on the primary and secondary are noted. With this data one of the fixed tuners is wound with the same number of turns, as noted, and the tuner marked with the call letters of the station corresponding and then laid aside. A second station is then similarly measured up and a second fixed coupler wound to agree with it. In this way the twelve tuners, or as many as may be needed, are wound and provided for as many stations.

The next step is, of course, to mount the same within the cabinet and make the proper connections. Finally, when each station represented among the fixed tuners is picked up on the receiving transformer it is switched in to the fixed tuner provided for it and the coupling made as weak as possible, the adjustable condenser's best position being also noted and recorded along with the corresponding station's call letter, etc. When the twelve tuners are mounted and connected the arrangement is similar to a telephone switchboard at a central exchange, where the operator can plug in any station desired without a volume of tiresome adjustments.

Returning now to consideration of the drawings, Fig. 6 is an assembly of the cabinet proper containing the strips for supporting the fixed tuners. This is best made of mahogany, but whitewood stained in imitation, or oak, may be used.

Detail No. 1 is the bottom of the cabinet, with strips for connecting the tuner supporting strips to the base and for receiving the front switch panel.

Detail No. 2 is the top of the cabinet. with similar strips.

Detail No. 4 is for the left and the right hand sides of the cabinet. It should be noted that not all the holes shown should be drilled in either piece, but that they should be drilled exactly as noted thereon.

Detail No. 5 is the back of the cabinet and is drilled for mounting fixed tuners and accommodating the coupling controlling rods for the same.

Detail No. 6 is the front switch panel, and is best made of hard rubber. The popular dull finish on hard rubber can be obtained, if desired, by taking off the polish with fine pumice powder and water. Hard fibre or even wood stained black may be used in place of rubber.

Detail No. 7 shows the coil forms for the fixed tuners, and is self-explanatory.

Detail No. 8 is the primary coil form of the receiving transformer.

Detail No. 9 is its secondary coil form.

Detail No. 10 shows the rods on which slides the primary.

Detail No. 11 is the hard rubber bushing for the secondary switch.

Detail No. 12 is the hard rubber base for the binding posts.

Detail No. 13 presents the tops and bottoms of the adjustable condensers. If adjustable condensers are already at hand these pieces need not be made, as the condensers can be mounted in place of them. Any adjustable condenser of large capacity will do.

Details Nos. 14 and 15 are the stationary and movable plates of the condenser, respectively, and demonstrate a method of cutting both plates from one square piece of plate. The diagonal lines are, of course, first cut, thus releasing the corner from which the movable plate is cut.

Detail No. 16 shows the separating washers for the condensers.

Detail No. 17 indicates the rods for the washers. The length of these rods is dependent on the thickness of the plates used and can be readily estimated once the plate stock is at hand.

Detail No. 18 is the switch lever for the secondary of the receiving transformer.

Detail No. 19 shows the fixed tuner switch lever. One end of one of these levers should cut to a point to act as a pointer.

Detail No. 20 is of the knurled adjusting disc which is to be screwed to the center of one of the switch arms shown in Detail No. 19.

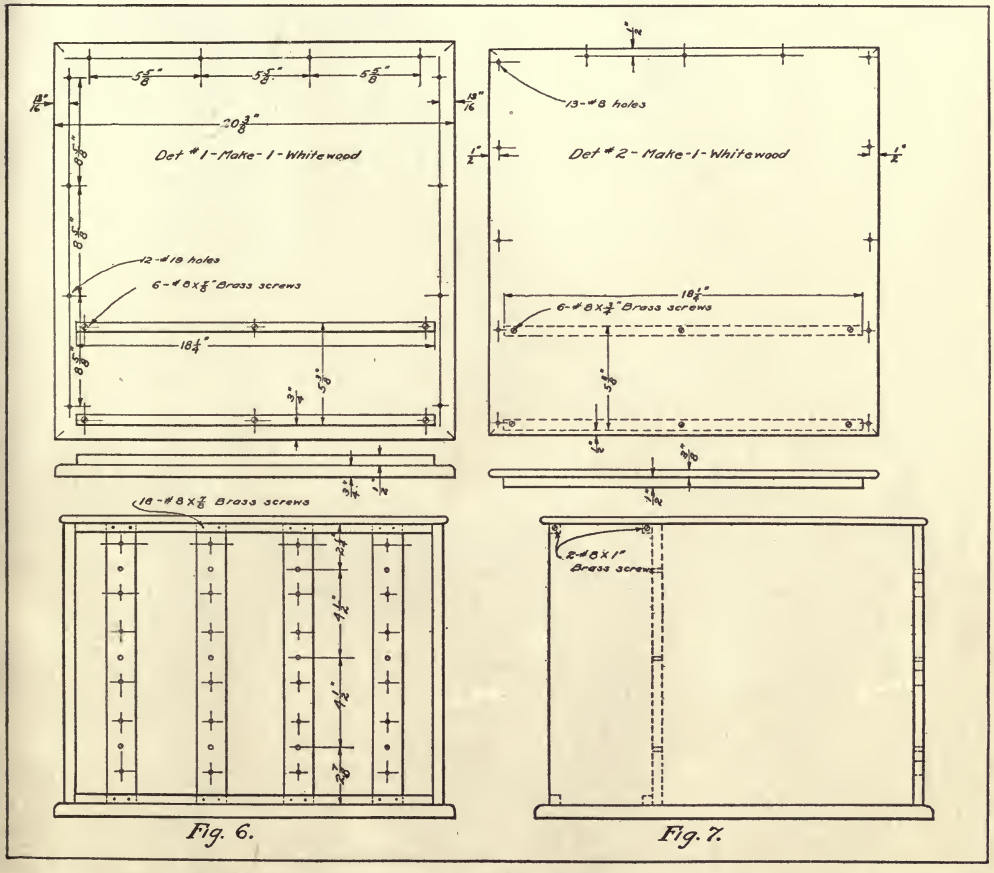
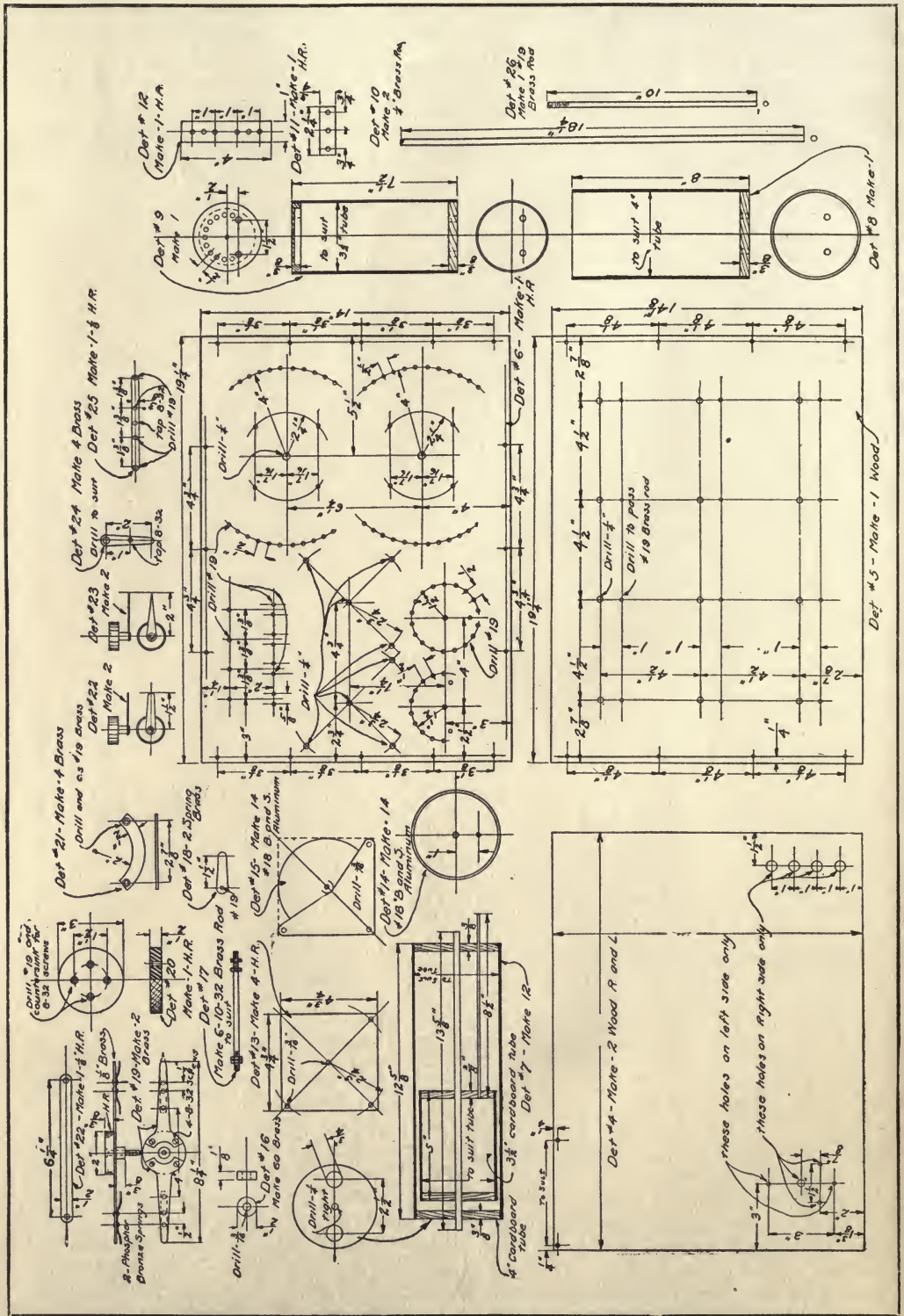


Fig. 6. Fig. 7.

Details of the Case for the Inductive Tuner. It is Best to Use Mahogany or Oak, although a Good Grade of Whitewood can be Substituted.


Def #12 Make-1-H.R.
Def #11 - Make-1-H.R.
Def #10 Make 2 - 1/4" Brass Rod
Def #26 Make 1 - 1/19 Brass Rod
Def #9 Make 1
Def #8 Make-1
Def #6 - Make-1-H.R
Def #5 - Make - 1 Wood
Def #24 Make 4 Brass
Def #25 Make-1-1/8 H.R.
Def #23 Make 2
Def #22 Make 2
Def #21 - Make-4 Brass
Def #18 - 2 Spring Brass
Def #15 Make 14 #18 B. and S. Aluminum
Def #14 - Make-14 #18 B. and S. Aluminum
Def #22 - Make-1-1/8 H.R.
Def #19 - Make-2 Brass
Def #20
Def #17 Make-1-H.R
Def #13 - Make 4-H.R.
Def #16 Make 60 Brass
Def #7 - Make 12
Def #4 - Make - 2 Wood R and L
these holes on left side only
these holes on right side only

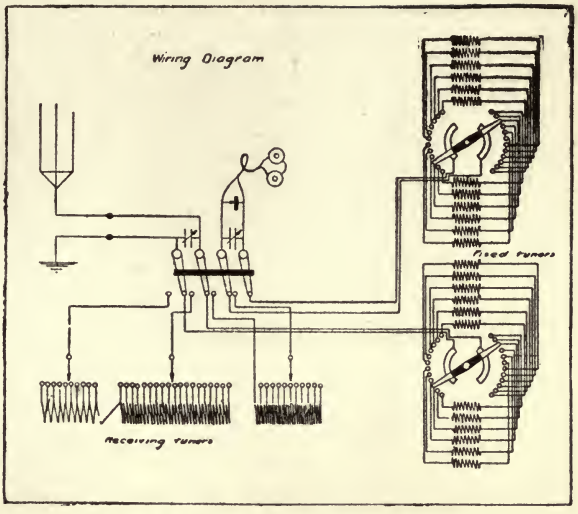
Detail No. 21 shows the contact strips for the switch levers in detail No. 19.

Detail No. 22 is the switch lever for the primary adjusting switches of the receiving transformer. The knobs shown are of the regular typewriter type. The best way to attach the lever to the hub of the knob is to turn a shoulder on the hub, force the lever on this shoulder and rivet it over. Soldering is difficult, as these knobs melt very easily.

Detail No. 23 shows the handles and pointers of the adjustable condensers. The remarks in detail No. 22 apply here also.

Detail No. 24 is of the levers for the circuit changing switch.

Detail No. 25 refers to the hard rubber connecting bar for the foregoing-mentioned switches.



Wiring Diagram for the Inductive Tuner.

Detail No. 25 refers to the hard rubber connecting bar for the foregoing-mentioned switches.

Detail No. 26 is the rod for the secondary switch on the receiving transformer.

The instrument should be carefully made, but does not present any great difficulties. When the fixed tuners are properly calibrated the instrument becomes a very valuable adjunct to the wireless station and indirectly acts as an indicator of stations picked up at random.

Considering more in detail the receiving transformer, it should be stated that the primary coil of the same is in this particular instrument wound with 225 turns of single cotton-covered magnet wire winding, approximately 40 turns to the inch; there being at the left-hand end ten sections of one turn each, while the remainder of the coil is divided into 18 sections, the first 15 sections thereof containing ten turns each and the remaining sections 25 turns each.

The arrangement just described, however, need not be adhered to in all cases, such, for instance, where a short aerial is used, in which case it would be desirable to wind the coil with finer wire in order to receive the long-wave stations.

The secondary of the receiving tuner is wound with single silk-covered magnet wire No. 26 or 28 and divided into 11 equal sections.

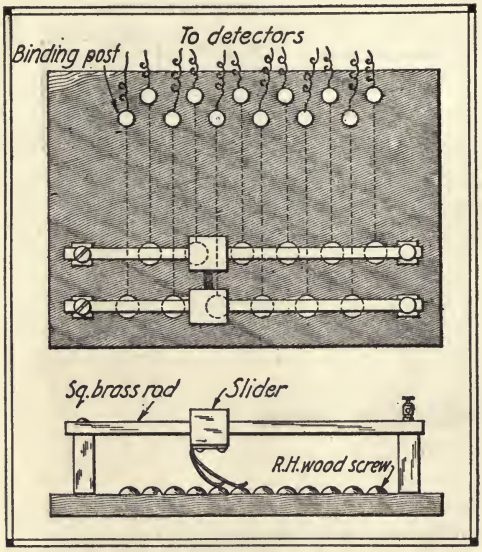
If, as is quite possible, the circuits should in practice require a loading coil to get perfect tuning, the fixed tuners may be wound with the number of turns required with a loading coil, thus replacing and thereby adding to the efficiency of the combination.

By providing on the two-way, four-lever switch described a third set of contact points, and making proper connections thereto, it is possible to arrange to use, if desired, the receiving tuner in cascade with one of the fixed tuners, and thus have a multiple receiving set with its correspondingly greater selectivity.

It is best that no shellac or varnish be used on the fixed tuner coils, as this increases the distributive capacity of the coils.

A LOG THAT CONTAINS 3,000 FEET OF LUMBER

The largest log yet found in the Northwest was cut down near Ridgefield, Washington. The log was twenty-four feet long and seven feet in diameter at the big end. The log contained about 3,000 feet of cedar. It was so large that the shed roof over the saw had to be raised to allow the log to get to the saw.



Any One of Several Detectors May be Cut In by Means of This Simple Detector Switch.

DETECTOR SWITCH HAS NOVEL FEATURES

A detector switch that will be found very useful for making comparative tests with various types of detectors is shown in the accompanying drawing.

The construction is quite simple. A block of wood measuring eight inches by six should be cut. Brass rods of the same approximate length as the block should be procured and fitted with sliders. The rods are to be mounted on the base about one inch apart. Contact springs are soldered to the under surface of the sliders, and the sliders connected firmly by a stout fibre bridge.

Round-headed brass upholstering tacks should be driven in the baseboard and wires led from them to binding posts. It will be seen by consulting the drawing that the tacks are "staggered," that is, the tacks in the two rows are not opposite. When one contact spring touches the head of one tack, the other spring will be resting upon the tack head a fraction of an inch in advance of it in the other row.

Detectors of various sorts can be connected to the binding posts, as shown. The two rods should be inserted in the receiving circuit in the same way that a single detector is inserted ordinarily.—H. S. PAINE.

PLYMOUTH RADIO ASSOCIATION IS FORMED

At a recent meeting of the radio amateurs held in Brockton, Mass., the Plymouth County Radio Association was formed and the following officers elected for the first term: President, Arthur Barnes; Vice-President, Fred Elliott; Secretary and Treasurer, Thos. C. Barham.

The purpose of the association is to promote good fellowship among the amateurs of Plymouth County as well as to aid them when obstacles are encountered. The association will be glad to hear from other similar institutions. Correspondence should be addressed to Thos. C. Barham, 833 Brockton Avenue, Abington, Mass.

MASSACHUSETTS RADIO CLUB ORGANIZED

The organization of a new radio club—The Massachusetts Radio Society—took place in May. The following officers, who are distributed over the state, were elected: Herbert L. Fowle of Reading, President; Leland Cummings, Stoneham, Vice-President; Dustin Downs, Stoneham, Secretary, and Herman Arnold, Stoneham, Treasurer. The new club announces that all wireless enthusiasts of Massachusetts who wish to join should communicate with the president or secretary for application blanks.

WEATHER FORECASTS SENT BY WIRELESS

It is announced that inland distribution of weather forecasts by wireless will soon be inaugurated for the Middle West. The plan contemplates the sending of forecasts for Illinois from the wireless station at Illiopolis between 12.45 P. M. and 1 P. M. each day. The station sending the weather bulletins will have a range of at least 125 miles and it is proposed to send the messages at a slow speed so that they may be read by the amateur wireless operators.

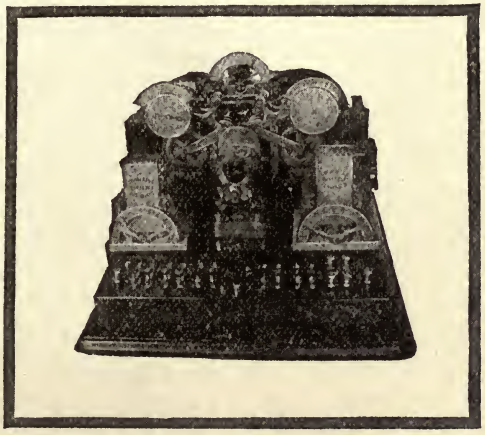
If you enjoy THE WORLD'S ADVANCE, tell others; if not, tell us your reasons.

An Automatic Receiving Set

By Austin C. Lescarboura

THAT a wireless receiving set should be no more complicated to operate than, a simple telephone switchboard or a typewriter is the contention of Walter Goodchild, a wireless investigator and inventor of New York. And in the way of proving his assertion this inventor has brought forth a most ingenious receiving set that may be operated by pressing various buttons.

The automatic receiving set, for such it must be called since all the tuning operations are automatically performed upon the pressing of various buttons, consists essentially of an inductive type tuner, a loading coil for the primary circuit and another for the secondary, two variable condensers and the usual accessories such as the detectors, fixed condensers and telephones. The different tuning instruments are controlled by a keyboard containing ten keys placed in a row at the front of the receiving set.



Front View of the Automatic Receiving Set: The Main Motor may be seen in the Center, and the Variable Condensers on Either Side of It. The Keyboard is Placed in Front.

The keys serve the purpose of closing various circuits which in turn operate the different instruments. They are divided into the following groups: The first two alter the coupling of the inductive tuner; the second two vary the primary winding of the coupler; the third two vary the winding of the secondary; the fourth two alter the adjustment of the primary condenser and the fifth two the secondary condenser.

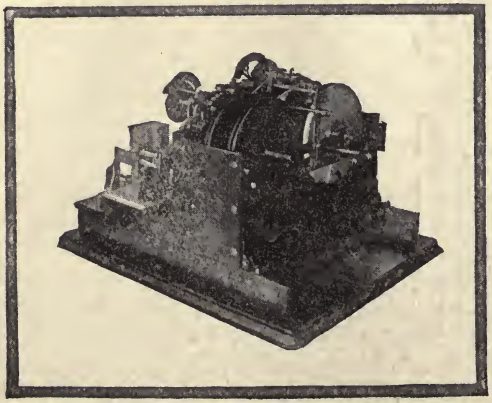
In order to adjust the coupling of the inductive tuner the first or "In" key is pressed, starting up a small motor which supplies the motive power for all the operations with the exception of the two variable condensers, each of which has its individual motor. A set of electro-magnets throws in a spiral drive which causes the inductive coupler coils to be brought closer together so as to tighten the coupling. To reverse the operation the "Out" key is pressed, resulting in another set of electro-magnets throwing in the spiral drive but rotating it in the opposite direction, so that the coils are separated further apart. Both the "In" and "Out" keys drive the coupling spiral in either direction as long as they are held down. When the spools are brought too near each other or separated too far apart, automatic circuit breakers come into play and cut off the motor's supply.

The inductive tuner in reality consists of four spools, although two are actually used for the tuner proper. These spools are mounted on shafts so that they may be revolved. Two spools are used for the primary winding and two for the secondary; the winding consisting of a flat copper ribbon coated on one side with enamel so as to insulate the turns. The copper ribbon winds one turn above the other on the narrow spools of the tuner, as much wire being placed on the spool of either the primary or secondary as is found necessary. The balance of the ribbon is kept on the companion spool. Contact with the copper ribbon is made at one of its ends, while the other end of the winding is connected by means of a spiral brass belt which also serves the purpose of keeping the ribbon in place.

In adjusting the inductive tuner the

keys of the primary and secondary circuits are pressed. When the primary "In" key is pressed the primary spools rotate so that the copper ribbon winds from the companion spool on to the active spool of the tuner. On the other hand, the pressing of the "Out" key causes the ribbon to unwind from the active spool on to the companion spool. The same procedure is observed in adjusting the secondary of the tuner. The tuning, obviously, is exceedingly sharp, since a fraction of an inch of ribbon can be reached by this method. Furthermore, the motor drives the spools at a fairly high rate and to wind the ribbon from one spool to the other is but a moment's work.

There are two loading coils used in this receiving set, one for the primary and the other for the secondary of the inductive tuner. These coils are wound on a flat spool and have taps taken off at certain intervals and connected with the contact points of switches. Over the contact points slide switch arms which are operated by a pair of electro-magnets through a ratchet movement. To cut in or out the loading inductance in the primary or secondary, the same sets of keys —the second and third couples—as were employed to operate the winding on the primary and secondary spools, are pressed. However, in this instance, one of the keys of the first group is pressed, operating as a "shift key," to use the expression of the inventor. By pressing the shift key the differentiation is made so that the switches are operated instead of the winding. The "In" keys adjust the primary or secondary loading coil switches; the "Out" keys adjust the same switches in the reverse direction. The reason for the shift key is that it saves at least four extra keys, the addition of which would unduly complicate the manipulation of the receiving set. Mr. Goodchild states that a separate shift key in the form of a long bar will be used in the future.



A Partial Rear View of the Set: The Black Inductive Tuner Spools may be Seen, as well as the White Spool of the Loading Coils.

The last four keys are used in controlling the condensers in the primary and secondary circuits. Each condenser consists of a large number of brass sheets separated by a special insulating fabric. Brass rods passing through holes bored in the plates serve to short circuit more or less of the condenser, thus varying the capacity in circuit. A small motor operates each condenser, cutting in more or less plates until the required capacity is attained.

The automatic receiving set is quite simple to operate. It is claimed by its inventor that within twelve seconds every tuning operation can be performed throughout its scope. The first step in tuning is to press the "In" coupling button so as to bring the coupler spools close together. The loading coil switches are then adjusted, followed by a closer adjustment by means of the ribbon windings. Finally, the sharpest tuning is sought by adjusting the primary and secondary condensers. The operator can then make the coupling looser if he so desires.

By the introduction of a keyboard the operation of a receiving set is greatly simplified, for, after once learning the different functions of the buttons, any one can receive signals without having to master the action in back of each button. Dials are provided on the different parts of the set so that an operator can pick up any station at any time by knowing the necessary adjustments of the different parts.

The motive power is supplied by a twelve-volt motor operating from a storage battery. The two condensers each have individual motors that draw their supply from the same battery as the main motor. The various pairs of electro-

magnets also take their current from the common battery; these electro-magnets serving the purpose of throwing in various friction drives as the buttons are pressed. The main motor is mounted on a felt base and has a special gear case filled with oil, insuring practically silent operation.

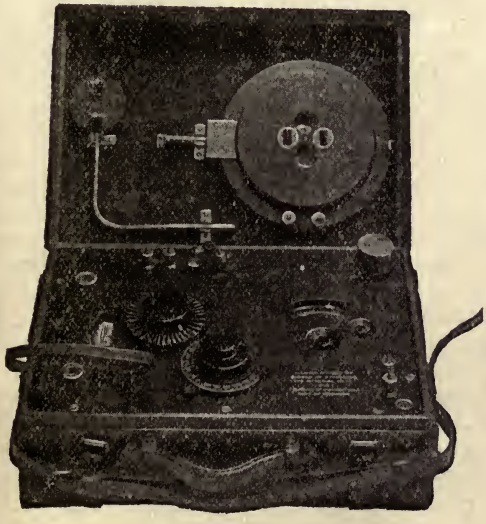
Weighing but thirty pounds in all, the automatic receiving set, aside from its use by amateurs, Government and commercial operators, promises to become widely used on aircraft, according to Mr. Goodchild. That it is ideal for this purpose would seem true from the fact that an aviator could press the different buttons while driving his machine, whereas the average receiving set would require too much attention. Furthermore, by the use of a fixed and permanent detector that requires no adjustment whatsoever and is not affected by vibration, which is incorporated in the set, the outfit is absolutely dependable.

But the greatest field of employment of the automatic receiving set will probably be on shipboard in times of disaster, either to the ship on which it is installed or when the ship is speeding to the succor of another vessel in distress. By means of a multi-conductor cable and a small push button board the receiving

Especially Intended for Amateur Use, this Inductive Tuner is Designed along the Same General Lines as the Automatic Receiving Set. It is, However, Manually Operated

set in the wireless room can be operated from the bridge or, for that matter, any other part of the ship. The operator, receiving messages and standing beside the captain and other officers, can keep them constantly informed regarding the messages he is receiving.

The appearance of the automatic receiving set marks a new step in wireless. It is but a forerunner of the efforts that are bound to follow towards simplifying radio apparatus and bringing its operation within the scope of the laity.



A Portable, Direct-Reading Decremeter Designed by Professor Kolster of the Bureau of Standards.

AN INSTRUMENT FOR MEASURING DECREMENT OF TRANSMITTERS

Professor Kolster, of the Bureau of Standards, has recently designed an instrument by which the decrement of a transmitter may be measured. The instrument is now largely employed by radio inspectors in determining whether or not transmitting sets are tuned sufficiently sharp to emit the waves in keeping with the wireless laws.

A Telephone Receiver of New Design

By Charles Horton

THERE has lately appeared on the market a new type of wireless receiver that is claimed to be far more sensitive than any in present use. The extreme sensitiveness of this new receiver is due to the employment of an entirely new and novel arrangement of parts.

In the accompanying drawings appears a semi-diagrammatic view of such a receiver arranged to show clearly the arrangement of parts, as well as three views showing the operation of the receiver.

The new receiver consists of a ring type permanent magnet, *A*, provided with U-shaped pole pieces of soft iron, B^1 and B^2. Supported between these two pole pieces is arranged a flat coil of high resistance, *C*, having a slot at its center in which is balanced an armature, also of soft iron, *D*, which is arranged for limited rotation about the pivot *E* in the center of the coil. One end of this armature, *D*, is connected by means of the wire, *G*, to the mica diaphragm, *F*. All the parts described are neatly mounted in a hard rubber case of the usual head type.

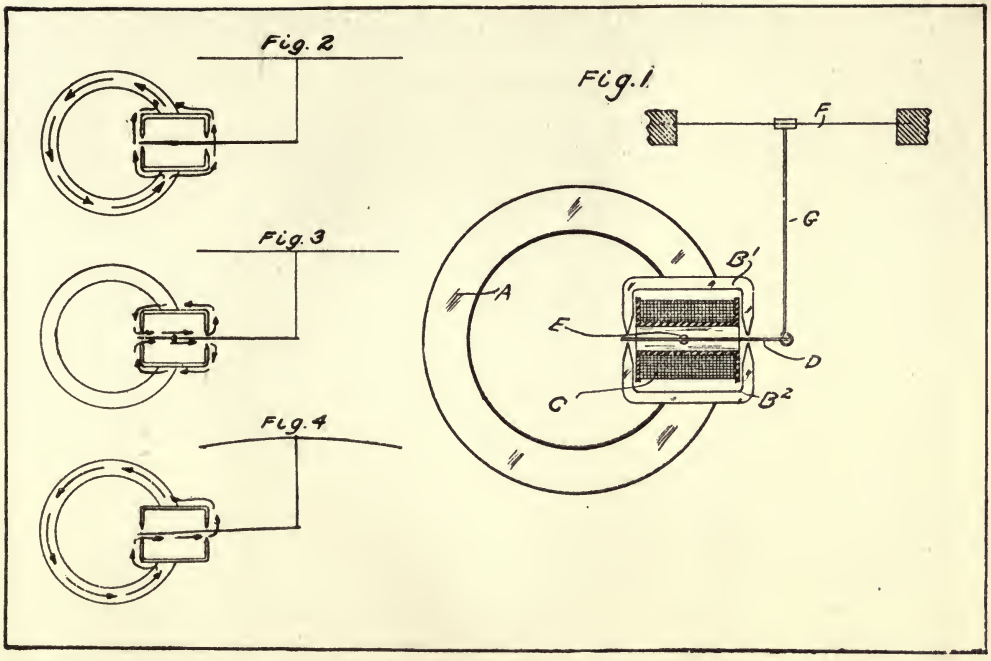
The operation of the receiver is apparently as follows:

In Fig. 2 the arrows on the permanent magnet represent the path and direction of the magnetic flux in the receiver when no current is flowing in the coil, and it will be seen from this that the flux produced by the magnet divides equally through the two limbs of the U-shaped pole pieces and to the lower pole pieces, it is under no strain whatever, and consequently the mica diaphragm is not at all deflected. This is quite a contrast to the state of the diaphragm in the ordinary receiver, which is deflected towards the permanent pole pieces at all times.

If, now, a current is caused to flow through the instrument, say a direct current of constant value, the coil sets up a flux through the armature longitudinally; this flux, as in all solenoids, passing out of one end of the coil and in at the other, as shown by the arrows in Fig. 3. The flux also divides and flows equally in both U-shaped pole pieces and thus the armature at both ends is equally attracted to upper and lower pole pieces and is thus under no tendency to change its position. It will be seen that acting separately neither the flux due to the permanent magnet nor the flux due to the coil has any effect on the armature.

The action is quite different when both fluxes are acting simultaneously. In Fig. 4 this effect is clearly shown by the arrows. The flux from the permanent magnet in attempting to pass up through both branches of the lower U-shaped pole piece meets in the left branch a part of the flux due to the coil, which is in the same direction as itself. On the other hand, the flux, in attempting to pass up through the right branch, is opposed by the same flux from the coil, which passes downward. Likewise, the permanent magnet flux in continuing its flow upward attempts to pass up through the left branch of the upper U-shaped pole piece and is here opposed by the descending flux from the coil, while in the right branch it is assisted by the ascending flux from the coil. The final result of this opposing and assisting of the flux from the permanent magnet is to cause a strong flux to flow in the magnetic circuit as shown by the arrows and a weaker flux to flow in the parts of the magnetic circuit not included in the circuit outlined by the arrows. Owing to the strong flux the armature is attracted at its left hand end to the lower pole piece and at its right hand end to the upper pole piece and consequently is slightly rotated on the pivot *E*. The movement is transmitted to the mica diaphragm through the link *G*.

It will now be easily understood that should a current flow in the coil in the opposite direction to that which we previously supposed, the resultant flux in the magnetic circuit will be from the lower end of the permanent magnet upward through the right hand branch of



A Schematic Drawing of a Telephone Receiver of New Design, as well as Diagrams of the Magnetic Circuits and their Effects on the Diaphragm at Different Periods in its Operation.

the lower U-shaped pole piece, longitudinally through the armature and through the left hand branch of the upper U-shaped pole piece to the upper end of the permanent magnet, and thence through the permanent magnet to the other end. In this case the armature is rotated in the opposite direction on its pivot and transmits to the diaphragm a movement in the opposite direction to that in the previous case.

The extreme sensitivity of the new receiver is probably due to two causes: First, that the diaphragm is at all times when not acted upon in nowise deflected and therefore—as in the case of a spring—is easier to deflect than a diaphragm which is under constant strain as in the ordinary types of receiver. Secondly, that the armature is acted upon at both ends and the flux is produced differentially, a very similar action to that existing in a polarized relay.

The receiver is undoubtedly more delicate than standard types, but, it is claimed, owing to its great sensitiveness, it will probably be widely adopted in wireless work.

CONTAINERS FOR WIRELESS INSTRUMENTS

Serviceable cases for condensers, test buzzers and other wireless instruments can be easily made from cigar boxes. The labels of the boxes can be readily removed by thoroughly moistening them, followed by scraping. The top and bottom of the boxes are apt to warp but this can be prevented by gluing across the inside small strips of wood.

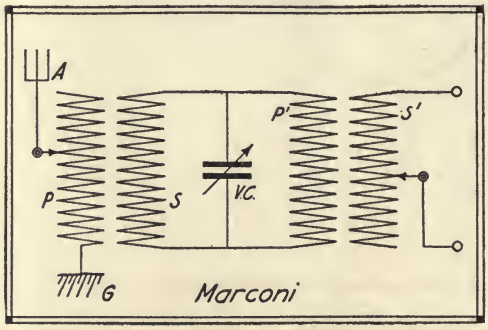
For large fixed condensers, the cigar boxes used as containing cases can be filled with melted paraffine. This will insure good insulation. In the case of a test buzzer the noise can be materially lessened by packing felt, waste or excelsior around the buzzer.—JOHN B. RAKOSKI.

A New Type of Multiple Tuner

By Thomas W. Benson

THE multiple tuner has in actual practice shown its superiority over all other common methods of tuning and, despite its selectivity, it is rarely found in the amateur's station.

A multiple tuner is one in which an intermediate circuit is used to transfer or carry the energy from the aerial circuit



A Diagram of the Marconi Scheme for a Multiple Tuner.

to the detector and 'phone circuit. The advantage of this arrangement lies in the fact that as the intermediate circuit has little or no damping it oscillates longer even when energized by highly damped waves in the aerial circuit. These oscillations, having a small decrement, can be sharply tuned by the detector circuit, resulting in great selectivity.

The disadvantage, however, of the multiple tuner has been in the room it takes up, requiring as it does two sets of variable, inductively coupled coils, besides the various variable condensers. To overcome this Prof. Cohen, of the Bureau of Standards, has brought forward a tuner possessing all the selectivity of the Marconi type with only two inductances, and he secures loud signals, due to his extremely close coupling.

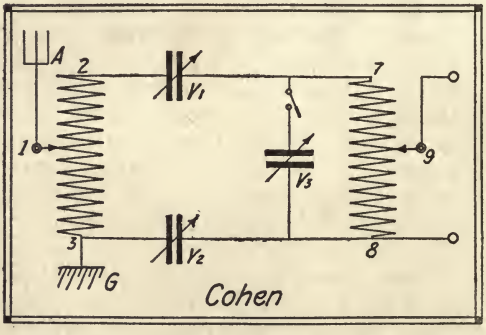
In Fig. 1 are shown both the Marconi and Cohen circuits, simplified, of course, to enable them to be understood at a glance.

In the Marconi hookup the intermediate circuit consists of inductances S and P^1 which are of fixed value, and variable capacity VC which is used to tune the circuit.

In the Cohen circuit instead of inductively coupling the intermediate circuit he connects it direct, thus coming back to the double slide tuner days. His apparatus actually consists of nothing but two tuners connected together with the variables. The middle circuit in this case, therefore, is formed by 2, V^1, 7, 8, V^2, 3 and V^3. This circuit is closely coupled both to the aerial and detector circuits and this explains the louder signals.

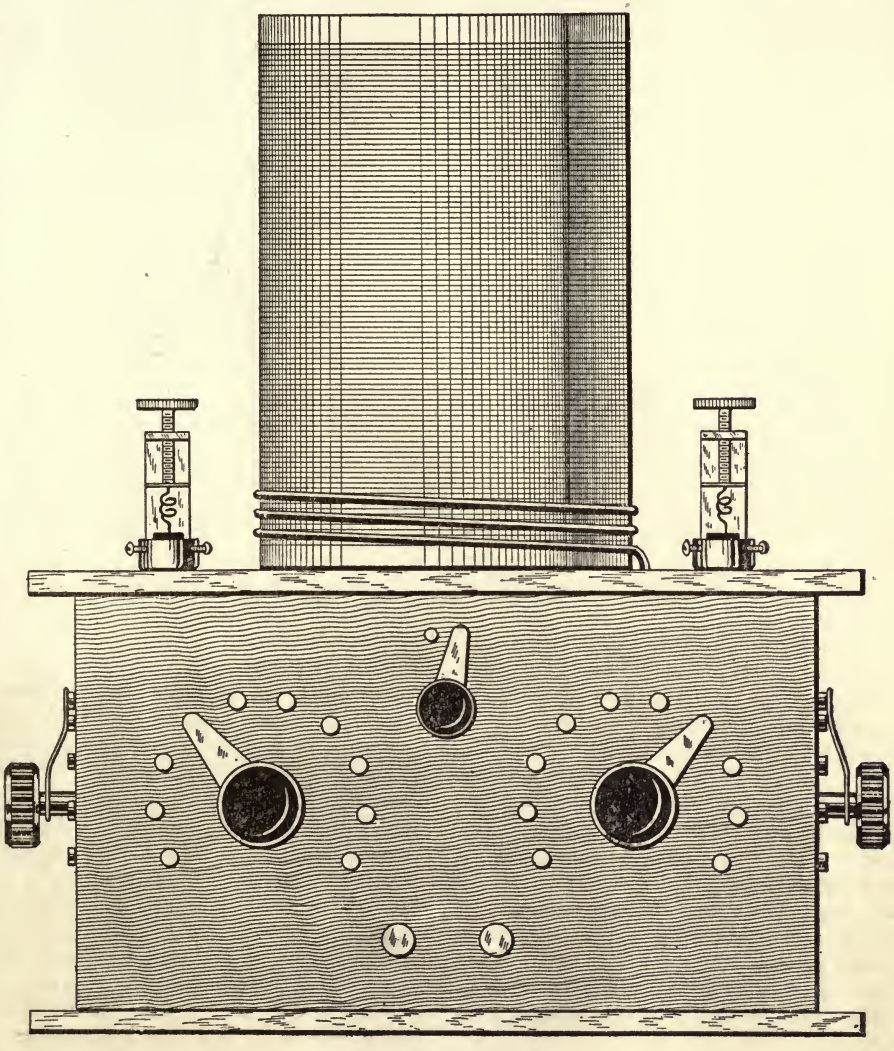
The condensers are used to tune this intermediate circuit, but it will be noticed that V^3 has a switch to cut it out and by following the next few paragraphs carefully it will be shown how it is possible to design a multiple tuner that will not need any condensers in the intermediate circuit.

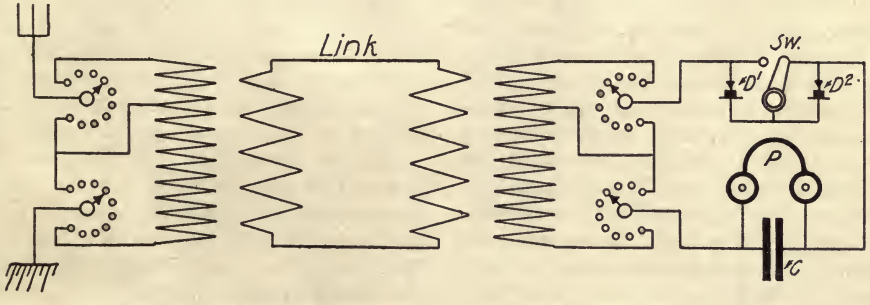
Consider V^3 switched out of the circuit, add series capacity by turning V^1



Wiring Plan of the Cohen Circuit for a Multiple Tuner.

and V^2 and as the capacity is added the wave length, to which the circuit will respond, will become shorter and shorter until a point will be reached, provided there is sufficient capacity, when the inductances will be offset by the capacities and a circuit will have, practically speaking, no capacity or inductance. That is, although both are present, they counterbalance each other and neither has any effect on current flowing in the circuit.




Link
SW.
D1
D2
P
C

Under this condition it would be thought that no energy would be transferred to the detector circuit, but, as a matter of fact, the opposite is true. This sounds far fetched, but here is an analogy:

Every one has read of Tesla's experiment where he puts a heavy ring of copper in a high-frequency field. What happens? He induces so much current into that ring that it grows red hot and, if continued long enough, it melts.

Now, returning again to the circuit in the Cohen tuner, the question is asked: "Can you induce a current in a circuit possessing no capacity or inductance?" The answer is yes.

Following up this line of reasoning, it will be noticed that if we could do away with the effect of inductances in the intermediate circuit we could remove the capacities likewise. It is, of course, impossible to entirely remove the inductances, but we can reduce them to such a small amount that their effects on the circuit will not be noticeable to any great degree.

This is done by using two or three, no more, turns of stranded wire for each coil in the linking circuit and keeping the leads between them as short and straight as possible.

In Fig. 2 are shown the hook-up and a front view of a cabinet incorporating the link circuit. Of course, the coils of the aerial and detector circuit should be so placed as to have a minimum amount of direct inductive effect on each other and this can be obtained by placing them some distance apart or by placing their axes at right angles to each other, as is done in this case to make it as compact as possible.

The box is made of ¼ inch walnut or mahogany and fastened together with brass screws. The dimensions are optional with the builder. Holes are drilled in the front to accommodate the two ten-point switches and the small two-point switch as well as the binding posts for the 'phones shown near the bottom.

Each end is also drilled for a ten-point switch. The switches on the ends have every other turn connected to their contacts, while those on the front have twenty turns between contacts.

The coils are similar and wound on cardboard or fibre 6 inches long and 4 inches outside diameter. They are wound with No. 24 enameled wire topped every other turn for the first twenty turns and then every twenty turns till 200 more turns have been wound on. The taps from the coil mounted on the top of the box should be taken down the inside of the tube, while those from the coil inside the case can be run direct to the switches.

The right-hand switches control the primary and the other two are for the secondary adjustment. The aerial and ground binding posts can be mounted anywhere the builder decides.

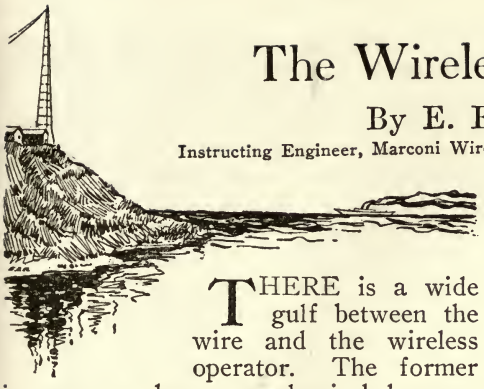
The link circuit consists of three turns taken around each coil, using No. 18 stranded copper wire; silk covered flexible cord is the best. These coils are wound around the end of the coil from which the top is taken at every other turn so as to always be in the active field of the coil.

The type of detector is immaterial, but the shorting and selecting switch deserves special attention. The two contacts of this switch are mounted very close together, so close that the switch blade can bridge the two. Now referring to the hook-up, it will be seen that the detectors are really in series and the switch shorts the one not in use, but when the blade bridges both contacts both detectors are shorted. This method saves the expense and trouble of having a separate switch to short the detectors when sending.

In using this set the switches on the front are adjusted first for coarse tuning and when the signals are the loudest the other two are used for fine tuning.

The selectivity is high, due to the linking circuit having practically no damping and though not capable of sustaining oscillations it will not damp them out, thus enabling sharp tuning and the elimination of stray currents and static.

The set described will tune to about 600 meters or higher if variable condensers are added in parallel to the windings. In the latter case the two switches on the ends may be done away with and the two variable condensers inserted into the open ends of the tube inside.



The Wireless Operator

By E. E. Bucher

Instructing Engineer, Marconi Wireless Telegraph Company of America

THERE is a wide gulf between the wire and the wireless operator. The former is more or less a mechanical human; he is simply the interpreter of the little instrument before him. He has no problems, no responsibilities outside of those of transcribing the message. He rarely has thrilling situations nor is he called upon to face unusual conditions. He is not placed upon his own resources. A skilled force is maintained to take care of the engineering details of his work. He is not thrown in contact with new peoples and surroundings. On the other hand, the wireless operator is a trained engineer who possesses basic knowledge of his profession. In addition to his knowledge of the telegraphic codes he is required to exercise his mental faculties in the everyday routine. He is—so to speak—in charge of a small laboratory, the efficiency of which depends to a large extent on his understanding.

What opportunities for development the profession of wireless operator offers! Men have worked for years to gain similar surroundings. One who has worked in the art for three or four years and is not a brighter and more alert individual owes it to himself for the failing.

The question is asked, "Where do these young men receive their training?" The great commercial companies maintain schools of instruction at various cities of the globe specifically for this purpose. Here young men of desirable qualifications, who have passed the mark of 18 years, are accepted and thoroughly schooled in the intricacies of the art. At a very nominal fee they receive a training in the elements of electricity which, at a future date, should fit them for a better position in the allied branches of electrical work.

They are taught the construction, design and assembly of the complete wireless equipment. They are taught what to do in an emergency and how to make repairs in case of accident. Their education does not rest on this alone but the geographical features of the universe are discussed and studied. Steamship routes are mapped out; distances are measured; important local conditions at each port are taken into account.

The student is instructed in the despatch of radio traffic—how to account for the tolls on a message. Intricate problems which may arise are solved. The student is thoroughly familiarized with the International Regulations by which the radio situation is universally controlled. He then passes a Government examination, receiving a certificate of proficiency. Could a more comprehensive profession be imagined? Or a more interesting one?

The applicant for admission to these classes must undergo a slight grilling. Entrance examinations are required and the boy who has long since left school is dazed at the questions asked. He finds the same old problems which he battled with during his later days at school.

Perhaps he is asked to add a column of fractions or to state where the north magnetic pole is located. He might be queried as to the number of days constituting the complete year or to name the months having 31 days. And then the old bugbear — decimal fractions. Again he might be required to disclose his knowledge of distances and he is requested to state the miles intervening between, say, New York and Buenos Aires or perhaps the time required to make a return voyage between these two points. But when he comes to the query, "How often does the earth make a complete rotation on its axis?" he throws up his hands in horror. Sometimes the replies received are humorous in the extreme. Take, for instance, the following description of the action and construction of a

telegraph sounder, a reply to a query of the entrance examination:

"A telegraph sounder is composed of a pair of magnets, an anvil and a hammer wound to a certain ohmage. When the electric current is put through the electric magnets it draws the iron crossbar down and bangs the hammer on the anvil, and when the current is stopped the hammer is released."

This young man is given a little private tutoring in the art of expression, and after a few weeks' training is able to describe the actions of such apparatus with grammatical and technical accuracy. Other statements are equally humorous, but none the less blameable. For instance, we have been told that it is 5,000 miles from New York to Colon, Panama; that the Panama Canal is 300 miles in length and a ship requires one month to take a round trip from New York to Southampton.

We are advised that the earth rotates on its axis once in a year and that the month of February has 31 days. According to some, there are only three seasons per year. The query as to which is the port or starboard side of a vessel elicits this reply: "The port side of a vessel is the side tied up to the dock!" and so on.

It is a difficult matter sometimes to convey to the raw recruit that time is an evasive factor and that at the same instant widely separated portions of the universe bear a different relation to the sun. The wonderment is intensified when as a trans-Atlantic voyager he sees the clock changed from day to day. He tries to keep pace with the changes and finally gives up in despair.

On his first trip to the land of the Southern Cross he receives another shock when he finds the moon on the north side of the continent. It takes days and days of reassurances from his fellow travelers to ground this fact in his consciousness.

Gradually he is lifted out of ignorance and provincialism and he is the better for the awakening.

It has been the writer's experience for some years to have under observation several hundred of these roamers of the sea. The psychological effects of environment are more than proven, and, like all man-made rules, unfortunately work both ways.

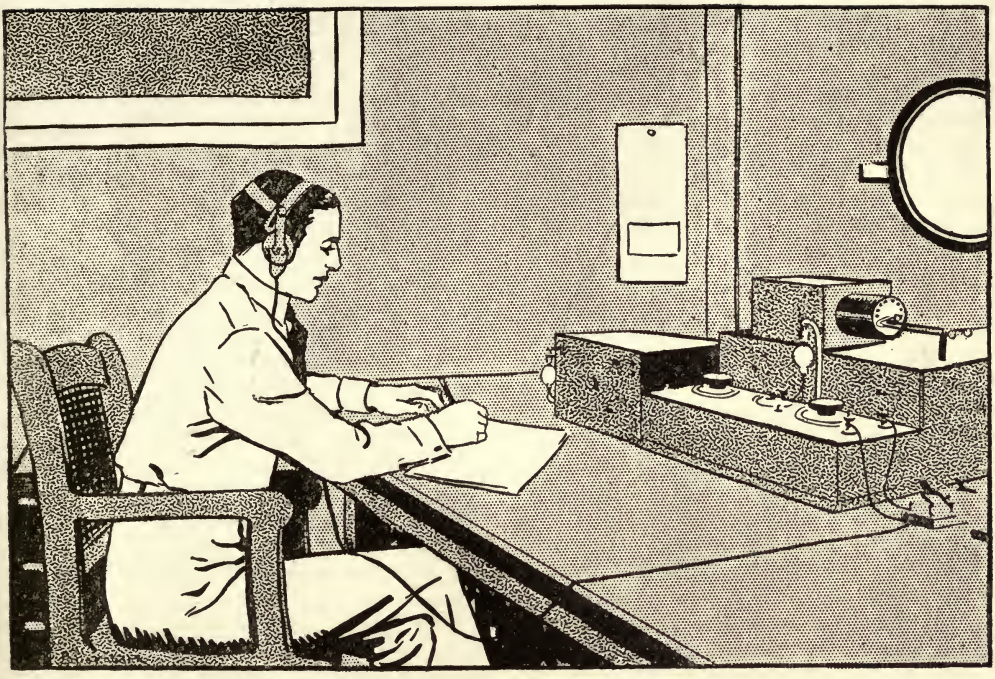
On one hand we have the newcomer who has not had the benefits of the better things of life and whose appearance is somewhat unkempt and slovenly. Perhaps he is careless in conversation and manner and affects an indifferent attitude to law and order. Several months at sea on the better class of vessels has completely transformed his disposition and manner. His entire being is changed. He is no longer slovenly, but dresses neatly. His form is erect; he is dignified and courteous. He has caught this atmosphere from contact with the better class of travelers. He can never return to old conditions and habits. He forms associations which some day when he has tired of the sea are certain to redound to his benefit.

On the other hand, in a few instances young men who have had the best of home training and environment have made companionships in distant seaports which have all but reduced them to a wreck. Fortunately, such cases have been very few indeed. After all, is not man the master of his own destiny?

The situations sometimes arising at sea are dramatic in the extreme. We are all familiar with the events of the past few years when these men have stood unflinchingly at their posts and then gone down with their vessel. These young heroes are reverenced and their feats proclaimed broadcast.

The writer never so appreciated the tenseness of the situation when a ship is in distress and the part the wireless operator plays until he met with an experience some few years ago.

While conducting some experiments in radio telegraphy on a Government vessel in Chesapeake Bay he was alarmed by an insistent call for help from the S. S. *Kentucky,* in distress a few hundred miles distant. The call "S O S" had not yet been adopted, but the operators made known their needs in no uncertain manner. A reply was sent from the station at Cape Hatteras, N. C., and somewhat later from a coast liner about 110 miles distant. After the situation had been explained there was a great silence, and one could not help but feel for the occupants of that vessel, particularly so on knowing that they were out of the path of regular traffic.



There is a Wide Gulf between the Wire and the Wireless Operator. The Former is More or less a Mechanical Human—He is Simply an Interpreter for the Little Instrument before Him. The Latter is That and Much More. He is Placed on His Own Resources; He Must Possess a Thorough Knowledge of His Apparatus, and What is Paramount, He Must be Big Enough to Face Disaster at any Moment.

After a while a faint sputtering came out of the stillness. "Hurry, the water is flooding our generators—our power is going." There was no need of going into details, the character of the signals was sufficient proof of the correctness of the statement. For several hours the ether was in a state of great calm about the Virginia capes. Government stations, commercial stations and vessels lying at their dock all eagerly listened to get a parting message from those whom they thought were going to certain oblivion. Communications between these several stations were very curt and limited to a few words. They could take no chances at losing even a letter.

A heavy spark thundered through the quiet. It was the station at Cape Hatteras. "S. S. *Alamo* has gone to the rescue of the *Kentucky* and should be there in two hours."

The relief was only temporary. Would the ship hold out until succor arrived? Would the helper be able to locate the helpless?

After this more intense calm than ever prevailed. It was interrupted a few hours afterwards by a faint message from the S. S. *Alamo* herself. "Crew *Kentucky* rescued—safe on board—vessel abandoned in a sinking condition."

Congratulations were exchanged between the ship and Hatteras and a sigh of relief was signalled from station to station. The *Kentucky* sunk shortly after being abandoned.

We should not forget, however, that wireless telegraphy was not primarily intended for the exploitation of the sensational nor for promulgation of heroic fame, but that its real value lies in the every-day commercial and humanitarian applications.

Contrast the situation of fifteen years ago with that of today. Only a few days ago the operator on a trans-Atlantic vessel told me that when in mid-ocean he was simultaneously in touch with the great Marconi station at Poldhu in England, the Eiffel Tower in Paris and the high-power Government station at Arlington, Va.

It is work of this nature which inspires

these young men in their labors, and, in their own language, "Keeps the ball a-rolling."

What becomes of these roamers of the deep? Are there opportunities beyond the mere profession of operating? To be sure. If he remains more than four years at sea he usually decides to make it his life work. There may be a vacancy at a shore station, where he settles down for an indefinite period. Then there is a berth awaiting him at one of the large trans-Atlantic or trans-Pacific stations. Here he either enters the traffic division or becomes one of the engineers. He indeed enters a new atmosphere. He finds comfortable hotels with every possible modern convenience, or perhaps a private cottage erected by the company. His work is of added dignity and importance—he finds a certain social atmosphere which makes life more real.

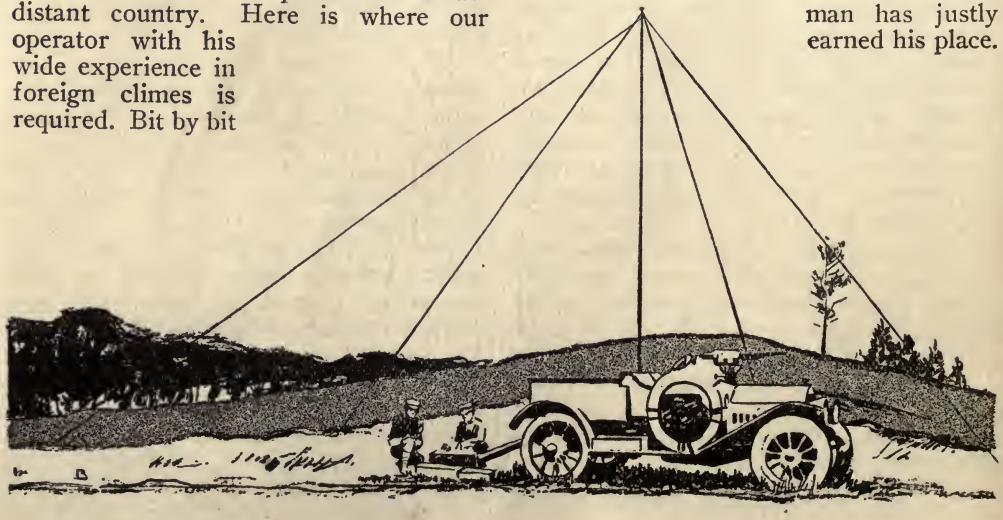
Perhaps he is in charge of more complex apparatus than was entrusted to his care at sea, and he therefore receives increased compensation.

A vacancy occurs in the engineering department requiring a man of wide, practical and theoretical experience. A man from the ship service is selected. Soon he is an invaluable assistant. Again, he may join the research department, where his work is indispensable. Perhaps the ship fitting department requires a new employee, and he, too, is selected from the sea rovers.

Then it is decided to erect a land station of considerable importance in a far-distant country. Here is where our operator with his wide experience in foreign climes is required. Bit by bit he has become familiar with the language of this particular country. He has an array of statistics he has collected during his various visits, which are now invaluable to him.

He is selected to supervise the job. The station is completed in due time and our former sea rover now becomes a land *voyageur*. He is sent to out-of-the-way places to connect up widely separated and impassable districts. He assists in welding together the broken links of advancing civilization. He is engaged in a noble work, the far-reaching consequences of which he has not yet realized. Now he is in an outlying island of the South Seas. Next he is in the interior of Africa, then we hear from him in the jungles of Brazil. Perhaps he accompanies a polar expedition or assists some boundary commission in locating the line of division between two semi-belligerent countries.

He erects portable wireless stations to assist in this work. In the meantime his knowledge of affairs, people and conditions is on the increase, and after a number of years he returns to his native country. He is now a man whose word in engineering problems is final. There is no occasion for dispute. There is a position awaiting him at the home office. He is now in charge of a great engineering force which is engaged in a universal radio development. He directs the fundamentals. He is assisted by a small army of co-workers. This man has justly earned his place.



STATIC—NATURE'S PROTEST AGAINST WIRELESS

THE most difficult problem that the modern wireless engineer has to contend with is the elimination of "static" or "atmospherics." The recent interruptions in the radio service between Nauen, Germany, and Sayville, Long Island, are entirely due to the increase in strength of these disturbances during the summer season.

Static may be defined as any form of natural electrical discharge which produces undesirable noises in the head-telephones of a wireless receiver. The radio signals proper are heard as long and short buzzes of various pitches or frequencies. The atmospheric noises are crashes and rumblings of a very low pitch, which may on occasion completely drown out the signals and render communication impossible. They are the curse of the commercial operator because they prevent the delivery of messages and cut down his commissions, and they embitter the life of the amateur experimenter, who can hear distant stations only when the air is absolutely quiet.

Static interference is caused in two ways:

During the spring, summer and fall the potential of the air in the vicinity of an aerial is higher than that of the ground. This difference of potential causes bursts of electricity from the air through the wires and instruments down into the earth. In the Philippine Islands Government stations these local discharges become so violent at night that the telephone receivers and the tuners of the receiving instruments are burnt out and the operator's life put in jeopardy. Even in northern States of our country, where conditions are not as bad as in tropical regions, the "riggers" who erect large aerials frequently receive severe shocks when the wires are ungrounded.

The second kind of atmospherics is caused by lightning discharges which radiate "stray" ether waves in every direction for hundreds of miles. A thunder-storm off Hatteras may in this way tie up radio traffic all along the coast.

So far all attempts to get rid of the demon Static have been in vain. The use of very high-pitched, shrill, musical signals has made possible the reading of messages through moderate disturbances, but that this remedy is not sufficient is shown by the sad experience of the Sayville and Nauen stations, which employ the most modern apparatus in this respect. All attempts to filter the static impulses from the legitimate wireless oscillations and get them to take a separate path have failed. However, the ablest minds in the radio field are now at work on the problem and ultimate success is not too much to hope for.—CARL DREHER.

A SUBSTITUTE FOR AN AERIAL

During the stormy summer months, when many amateurs are deprived of their aerials, an excellent substitute may be found in the following:

Tap one of the wires of the nearest telephone wire and bring this wire to a fixed condenser. Connect the other terminal of the condenser to the primary of a loose coupler. With this improvised aerial, signals of considerable wave length can be received. As an illustration: An audion set using an ordinary aerial was barely able to receive Sayville, but when the telephone line was used WSL could be copied with the telephones on the table. This idea may also be used on single slide sets.—JOHN BUCKNAM.

On Tuesday, July 27th, the wireless station at Funabashi, near Yokohama, Japan, transmitted the first message to the station at Koko Head, Hawaii. These two stations are links in the world-encircling Marconi chain, which extends about two-thirds around the world and would probably have been now completed but for the European war.

What the World is Doing

THE inauguration of an Advisory Board of Inventors by Secretary Daniels, of the United States Navy, is a commendable achievement of the highest order. Likewise is the hearty support which the idea has received from the prominent inventors who have been fortunate enough to be invited to serve as advisors. Thus far, such names as Thomas A. Edison, Charles Proteus Steinmetz, Hudson Maxim, Orville Wright, Alexander Graham Bell, Professor R. A. Fessenden, Peter Cooper Hewitt, Nikola Tesla, Lewis Nixon, Henry Ford, Simon Lake and John Hays Hammond, Jr., have been mentioned in connection with the Board. These names are all synonymous of some of America's greatest industries and discoveries, and are truly household words. But the task before the men is one worthy of their skilled efforts, for they shall be called upon to examine thousands of ideas among which may lie many wonderful inventions requiring proper development. Their vast knowledge in many fields will be a tremendous asset.

It is but appropriate that the United States should at last have an Advisory Board of Inventors, for is it not the Americans who have given the warring nations a goodly part of their fighting equipment—the aeroplane, the submarine, the telegraph, the telephone and countless other inventions? Yet America today has made less use of these inventions as applied to warfare than the countries of Europe which have borrowed the ideas. In a large measure this is due to the lack of encouragement to inventors in the past. It is a matter of history that more than one American inventor, on failing to interest the authorities at Washington, has gone to the European governments and by them has been accorded every possible facility to demonstrate the worth of his ideas.

All this will now be changed by the existence of the Advisory Board of Inventors. At last the inventive genius of America—the most versatile in the world—will be granted a hearing and accorded every possible facility for the testing and developing of new inventions that may be of value to the Navy. In all probabilities there will be a testing ground established where ideas, after they have been approved of, can be tried out and subsequently developed under proper and skilled guidance. Once more, the idea is a highly commendable one and indeed worthy of the great men who have been given such an enviable opportunity of serving their country's interests.

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ELSEWHERE in this issue appears an announcement that must necessarily be of greatest interest to our readers—the purchase of the *Popular Science Monthly* by The World's Advance. The former is a publication of long established reputation, and its acquisition by this magazine is of greatest importance. Beginning with the October issue the two publications will be consolidated into a bigger and better magazine, which will contain more pictures, better pictures, more news of the world's advance and more pages of reading matter than ever before. In science, in invention, in mechanics, in electricity, the greater magazine will continue to give its readers Truth, which is ever stranger than fiction, and facts which are more absorbingly interesting than fiction.